EDITORIAL

SCIENTISTS are urging rigid control of man's activities in outer space — a pointed comment on the rapidity with which progress has been made in this field.

Only a few years ago, the idea would have seemed fantastic.

And yet there is nothing unrealistic about it. We just can't accept a situation in which rockets and loaded vehicles fly into space without adequate reason or purpose, and with perhaps great prejudice to future and profitable plans.

It is easier to put a satellite into orbit than it may be to get it down. We mustn't fill the earth's vicinity with flying rubbish.

We must also suspect projects to fire projectiles into the moon unless some real purpose will be served by doing so.

The launching of any explosive missile at the moon is even more serious.

Some day men will be landing on the surface of the moon. What they will find there, a cross check on all the theories about our nearest neighbour, may be of the greatest importance and value. It's quite possible that a surface undisturbed as it has been for thousands of centuries would be a major portion of the prize of such a venture.

And to render the moon radio-active, even to a small extent, might ruin for ever the possibility of gaining vital information. We would never know exactly what the moon was like before it was hit.

In the event of a missile not striking its target, what will happen to it? It could conceivably return to the earth, and give us the dose intended for the moon. Or it might go into orbit around the earth, a potential menace for years to come.

Let's think a bit more about such proposals before going too far. International competition or prestige is not enough justification without a substantial backing of pure reason.

Talking of space control, what about the space outside our coastline? How long will small ships be allowed to roam the ocean without radio contact, forcing lives to be risked and money to be spent searching for them when they get into trouble?

To say nothing of the danger to the crews when such trouble does arrive, and they are helpless to meet it.

This is one kind of control we can usefully demand, and it should be so demanded without delay. Lack of radio in this enlightened age comes close to wilful negligence.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

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OUR COVER PICTURE

Three physicists of Iowa University inspect special tape recordings of the movements of Explorers 1 and 3. Ten inches of tape represents 5000 miles of travel. At left is a spare section of Explorer 1 showing instruments it carries.

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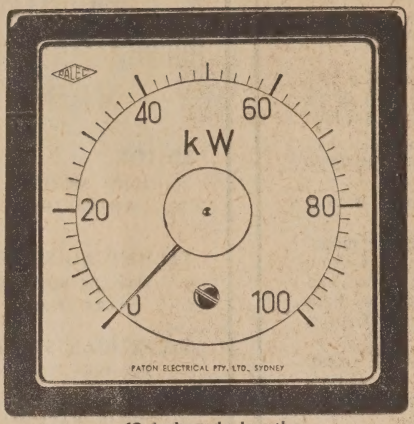
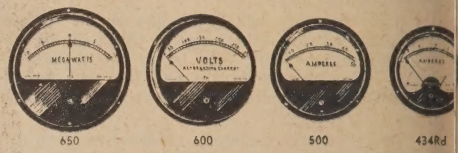


12 inch scale length



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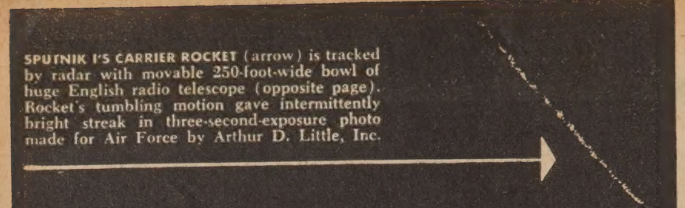
DE-FUELLING A 5-TON ROCKET

Protected by special clothing, two members of Britain's 47th Guided Weapon Regiment (Field), Royal Artillery, de-fuel a Corporal surface-to-surface guided missile. Developed in America, Corporal is nearly 50 feet long and weighs five tons. After practice firings, in U.S.A., the regiment will join NATO forces in Germany. (See P. 7.)



SPUTNIK I'S CARRIER ROCKET (arrow) is tracked by radar with movable 250-foot-wide bowl of huge English radio telescope (opposite page). Rocket's tumbling motion gave intermittently bright streak in three-second-exposure photo made for Air Force by Arthur D. Little, Inc.

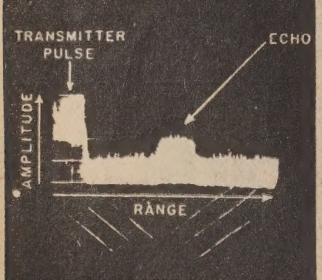
Messages from outer space:

What We're Learning from the Satellites

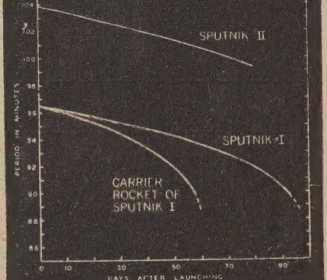
An enormous amount of information has been obtained from the various satellites which have been and still are encircling the earth. Just how signals from outer space are generated and actuated by recording instruments is something of a scientific romance. Man's ingenuity has enabled him to position his eyes and ears on the outskirts of the universe.

The satellites are paying off. From a region of mystery beginning 150 miles above the earth, the Space Age's new frontier and the gateway to the moon and planets and stars, U.S. and Russian artificial moons have been wresting the secrets we must know before man himself braves its perils. And the information being gleaned from Explorer and Vanguard satellites and from Russia's Sputniks is proving packed with surprises, riddles and invaluable hard facts about space.

Twenty-five miles of magnetic tape, 11 inches wide, arrived one day last February at Caltech's Jet Propulsion Laboratory in Pasadena. By oxcart and by plane, it had come from faraway Nigeria, Singapore, and other spots as remote. That was a typical day's news



Radar echo from Sputnik I rocket was obtained by a powerful MIT transmitter at Westmore, Mass. The echo's position, along the line marked "Range," shows the rocket nearly 600 miles away.



Satellite period (time to circle the earth) drops with altitude. At 87½ minutes the end is near. An 87½ minute orbit would graze the earth, but the moon burns up first.

from bullet-shaped, 80-inch-long plorer I as it wheeled around the e on the initial rounds of its 115-mi elliptical orbit, dipping to 219-altitude and zooming to nearly 1, miles.

Within its instrument-containing —a dark steel shell striped with w bands, to control solar heating— radio transmitters prattled away as cessantly as a news commentator. code made public so all the world c listen and understand—musical t forming dissonant chords until later scrambled—were the rapid-fire sig of temperatures, cosmic rays meteors in space.

Some messages went unheard were lost. But for periods of a five minutes apiece—whenever Expl 1 swooped within range of "Minitr and "Microlock" receiving stations over the world—the precious mess were caught and preserved on Thence they went to JPL; there d cate tapes were made and forwa to the State University of Iowa an the Air Force Cambridge Rese Centre, the others participating in experiments.

Hazards awaiting the space trav it now appears, will be less formid than many have supposed. That's gist of a sampling of Explorer's messages.

OUTER TEMPERATURES

Temperatures: 32 to 149 degrees That's Explorer's outer skin tem ture, reported by beadlike thermi and resistance thermometers; it's ing much less widely than expecte the satellite whirls from shadow to light. Inside Explorer's insulated 40 to 104 degrees F., everything is for batteries and transistors. (And too far from livable temperatures humans, when they get to ridin space cabins; probably that upper can be lowered a bit.)

Cosmic-ray count: 29...31...

That's from a geiger counter a Explorer, as heard in Nigeria, sou California, Florida. High, but dangerous, as it was feared the trating rays might be, up abov earth's protective atmosphere.

Meteors: .01 particle per square per second, 10 microns or larger scientific language, that's the sto an "erosion gauge," with one of fine wires severed by a meteoric p within the first nine days—and "impact microphone," recording ping of other particles that h satellite shell. In layman's langu means that bombardment by m of dust size and up, shouldn't much of a hazard as to prevent travel.

BABY TAPE RECORDER

Later U.S. moons introduce ments. The second Explorer p orbit had a tape recorder, desig State University of Iowa scient register all cosmic-ray readings— none would be lost—and read out on radio command from a station. Tiny Vanguard I's pr contribution has been successfu of a radio transmitter powered b cells, capable of transmitting d years, instead of the few we

t that chemical batteries last.
While Vanguard I reports only tem-
ature data, its 20-inch successors have
n designed to carry much more
orate scientific instrumentation.
biggest upset in space lore comes
n Sputnik I, and credit for it goes
he amateurs of Project Moonwatch,
tracked the 25-inch sphere of
shed aluminium with little low-power
scopes. "With very few exceptions,"
the Smithsonian Astrophysical Ob-
atory, "the only scientifically valu-
visual observations of the satellite
ber were obtained by Moonwatch
ns." From the observed orbit, the
ervatory's scientists have announced
artling finding.

t satellite levels the atmosphere ap-
s to be nearly nine times as dense
xpected. While it's so thin that it
amounts to a near-vacuum—only
t 1/3,000,000,000 as dense at 140
s as at sea level, by the tentative
estimate—the difference from pre-
ions strikes space planners like a
bshell.

explains why Sputnik I, which U.S.
rts originally expected to stay up for
ear or more, met a fiery end after
three months. Satellites must be
higher, it shows, to escape air drag
last as long as intended. The new
ng was announced in time for ap-
ution to Explorer I and Vanguard
. Since their orbits have minimum
hts of 219 and 407 miles, compared
bout 150 miles for Sputniks I and
they are expected to stay aloft for
s, instead of months.

CE PLATFORMS

lanners of future space platforms,
erve as way stations for travel to
moon and beyond, should also take
ce. Some, who have been talking
altitudes as low as 150 miles for
e stations, had better raise their
gs.

og-carrying Sputnik II proved for
first time that a living creature could
ive a week of weightlessness. While
had been surmised, previous "zero-
ity" experiments with animals were
ed to a few minutes, in falling
ets.

he space-travelling dog Laika, by
et report, was unharmed by weight-

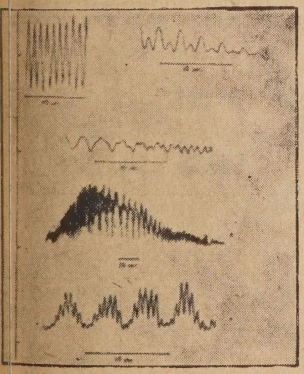
Dr. Karl Heinze of the Smithsonian Institution explains a giant IGY Satellite Tracking Camera. It is intended for photographic work. Twelve were built and installed at various places around the world. To the camera, a small satellite would be equivalent to a golf ball at a height of 60,000 ft.

lessness. It survived for seven days, artificially supplied with oxygen and food, while instruments reported its pulse, respiration and blood pressure until exhaustion of the power supply terminated the experiment and Laika.

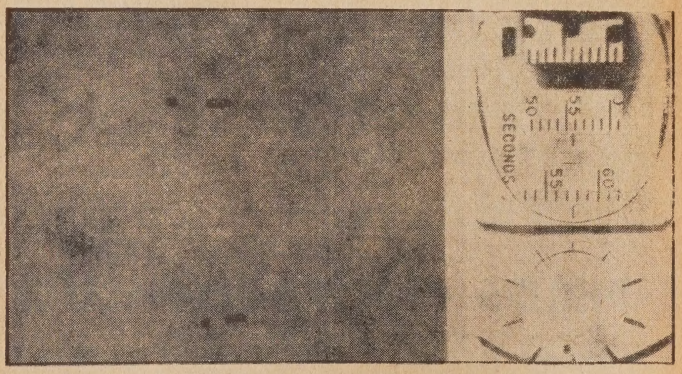
Surprisingly trailing the U.S. in announcing satellites' space data, the Russians took four months to reveal scientific details of the Laika findings. What else their Sputniks' beeps had told, in secret code, the world was still waiting to hear at this writing.

Simply by observing the Sputniks' orbits and their radio signals, however, Western scientists have been able to learn a great deal.

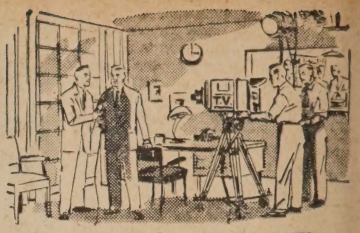
The earth's bulge at its waistline affects the satellites' orbits, so they should tell by how much the earth's radius at the equator exceeds its radius at the poles—and whether a current Russian estimate,

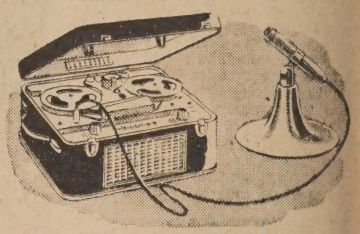


uiggles show many varieties of fading radio signals from Sputnik I. They ill aid studies of the ionosphere.



How the satellite looked to a camera photographed against a starry sky to fix position. Motions of the camera "stop" and "smear" the satellite (lower block marks) and star (upper block marks) from which its position will be measured. The film simultaneously registers time from a crystal clock, to an accuracy of 1/1000 of a second.





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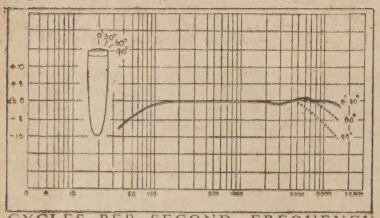
Due to the small diameter, reproduction quality is substantially independent of angle of sound incidence. Frequency response is unaffected by distance. Self-noise only 15 dB above threshold of audibility.



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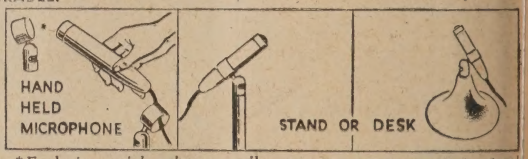

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PHILIPS

P279.SP

a different Western one, is the nearer
ht. Early satellite observations seem
favour ours. But settling the question
st await long study of precision photo-
phs being made with big satellite-
cking cameras. So must measurements
ected to give, more accurately than
r before, the distances between places
different continents—a matter of keen
erest to missile men as well as to
ntists.

Sputnik I had a "ghost." Sometimes
beeps seemed to be coming from right
rhead, when it was actually on the
posite side of the world—a new and
stifying radio phenomenon. And the
ps, reached radio receivers by other
ious paths, more devious than direct
e-of-sight. Unexplained varieties of
ing were recorded. Study of these
io observations may throw new light
the nature of the ionosphere, the elec-
ied region beginning about 30 miles
ve the earth's surface.

An Ohio State University scientist re-
ted echoes of WWV radio time sig-
s from Sputnik I—as from meteor
ls, but stronger and longer. Thus he
erved the sphere's final breakup, into
rocession of eight fragments taking 0
nutes to sail by.

Getting the satellites' data began in
r-frenzy. When Sputnik I startled
world last October 4, no one knew
sure how long it would stay up; its
cessful launching might be a lucky
ident not soon to be repeated. Ob-
vers must make the most of their op-
tunity. All night Moonwatch head-
rters alerted its teams by telephone,
egram and cable.

This had been the plan: First a satel-
li would be tracked by Minitrack's
ection-finding radio receivers—backed
by Moonwatch's visual observers just
ase the moon's radio failed to work.
Then, since optical tracking is much
re accurate than radio tracking, Mini-
ck's orbit predictions would direct big
cking cameras to the satellite and they
ld take over. But that was for U.S.
ellites still to come. Sputnik threw the
edule into confusion.

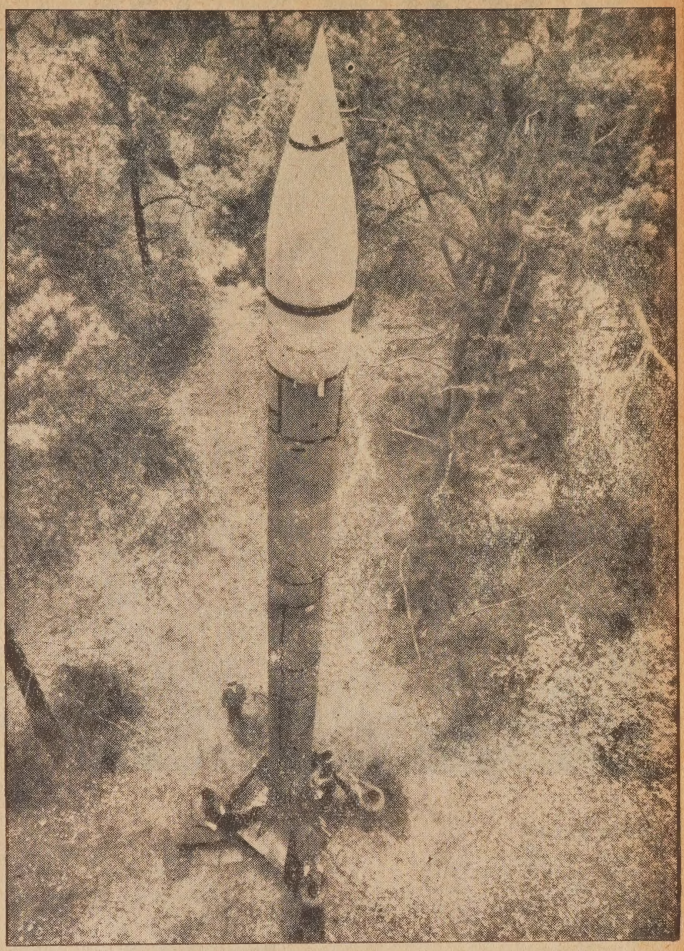
DIFFERENT FREQUENCIES

Ridiculous-looking little television-style
erials sprouted from Minitrack's great
dio antennas. Unknown to Western
entists until a few days before the
nching, Sputnik's transmitting frequen-
cies, to our experts' consternation, were
different from ours. As for the satellite-
cking cameras, the first of the 12 in-
ments was still short of completion
Pasadena.

So for a while it was unexpectedly up
the amateurs of Moonwatch to provide
the only available precision observations
of Sputnik I. And they covered them-
selves with glory. Not only did they come
through with hundreds of scientifically
useful sightings of Sputnik I's rocket,
and the harder-to-see satellite itself. They
even furnished nine sightings of the
rocket's separated nose cone, giving the
needed proof that it was also in orbit.

Radar, almost unheralded as a means
of satellite tracking, proved useful here
and abroad—especially in bad "seeing"
weather. Hastily converted into a radar
instrument, the great 250-foot-diameter
radio telescope at Jodrell Bank, England,
locked up Sputnik I—and, by cabled
Russian request, furnished orbit data
after the moon's batteries went dead.

BRITISH CORPORAL STANDING BY



The first British guided weapons regiment is now training with handling the "Corporal," a 45ft long American missile which can be fitted with a nuclear warhead. This striking picture was taken in a wood at Crookham, and gives an idea of what is involved in manoeuvring the weapon.

TRACKING CAMERAS

By now, the hectic improvisations of those first days are history. The big tracking cameras have gone into action. Completed in time to catch a few photos of Sputnik I and its rocket, the first was set up in New Mexico. Others have since gone into service in South Africa, Australia and Spain; by mid-June, all 12 should be working.

Developed at once, the camera's pictures immediately furnish data to a computer predicting a satellite's path, to help observers keep tabs on it. But the final precision measurements, and the scientific findings to result, will wait until the end of 1958 and the International Geophysical Year. Then all the photographs will be assembled at the Smithsonian Astrophysical Observatory for the painstaking task.

Meanwhile, watching the man-made moons might indirectly yield a surprise:

Will satellite observers discover any natural satellites, too fast-moving and small ever to have been seen by astronomers' telescopes, circling close to earth? Chances are considered dim, but the possibility still can't be ruled out. So the Smithsonian has been studying all reported satellite sightings that don't fit the orbit of any known man-made moon. If some of the offbeat data should fit together and yield a different orbit, at any moment we might hear the surprising news that nature has given our own satellites competition.

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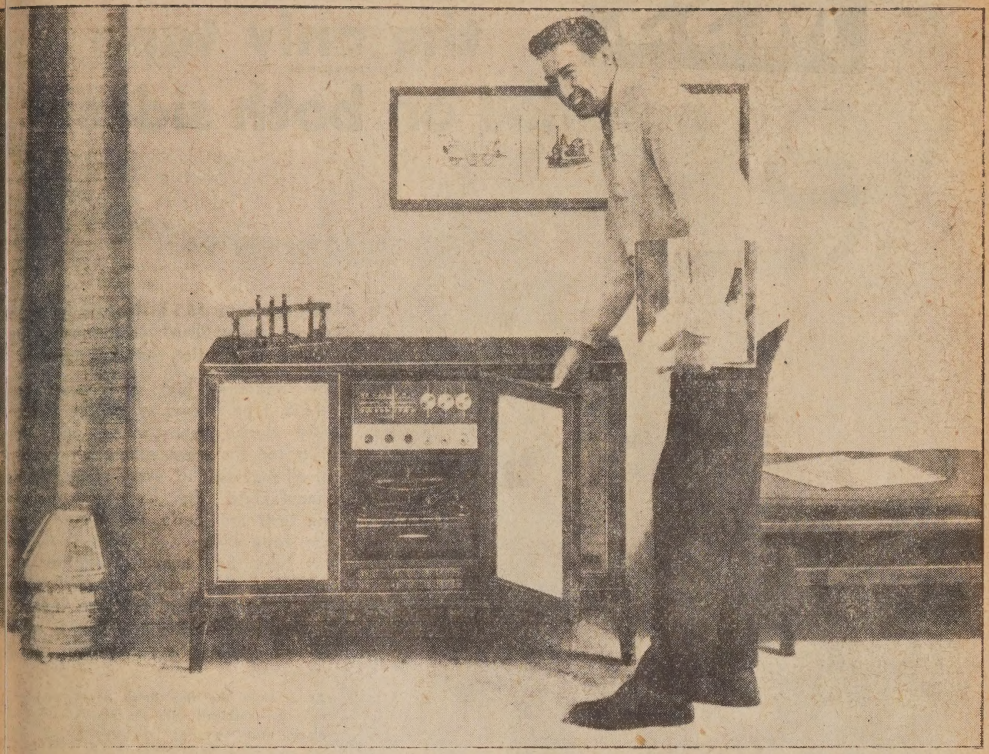
STEREOGRAMS APPEAR OVERSEAS



licating the shape of things to come this FM-AM stereo radiogram, just nounced in the U.S. by the Zenith dio Corporation. The stereophonic kup cartridge has 0.7 and a 3-mil phire stylii. A push-pull, dual- nnel amplifier system is incorpor- d, with a rated peak power of 80 tts. Two 12-inch woofers are used, h exponential horn type tweeters l an LC crossover network. Controls ude Compensation, Presence, Loud- ss, Balance, Bass and Treble. The tor is a 4-speed type and an input jack is available for stereo tape.

☆

tain's Postmaster-General plans that 1970, three quarters of all Britain's nk line calls will be made by the scriber dialling a code signal, fol- ed by the wanted number. Every will cost twopence initially, but g distance calls will be limited to rter periods unless extended by the insertion of additional coins.

M.S.S. the only tape polished on both sides!

This exclusive M.S.S. feature helps to ensure really "live" performances by almost eliminating surface noise.

The uniformly high performance of M.S.S. tape is ensured by the utmost care during manufacture and this calls for the most exhaustive testing of all materials at every stage. After manufacture, high frequency recording tests are made, the output from the tape being applied to cathode ray tubes and recorded photographically, so that, not only small variations in mean level, but also changes in sensitivity lasting less than a millisecond can be detected and measured.

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The excellent dispersion of the magnetic oxide in the coating, combined with the exceedingly small particle size, ensures extremely low background noise, giving a very high dynamic range.

Print through from layer to layer is negligible.

This professional quality tape, which is now available, can be supplied in the following lengths:

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Standard	**1,200 ft.**	**58/**
Long Play	**1,800 ft.**	**78/**

To people already experienced in the use of Magnetic Tape it will be immediately apparent that here there is something different.

N.S.W.: UNITED RADIO DISTRIBUTORS PTY LTD., SYDNEY
AUDIO ENGINEERS PTY. LTD., SYDNEY.

VICTORIA: HOMECRAFTS PTY LTD., CARLTON
J. H. MAGRATH & CO. PTY LTD, MELBOURNE
WARBURTON FRANKI (MELBOURNE), LIMITED. MELBOURNE

SOUTH AUST.: A. G. HEALING LTD., ADELAIDE.
RADIO ELECTRICAL WHOLESALE LTD., HINDMARSH.

QUEENSLAND: CHANDLERS PTY. LTD., BRISBANE.

WEST AUST.: LEROYA INDUSTRIES PTY LTD., PERTH.

TAPE RECORDERS PTY. LTD.

BOX 3456, G.P.O. Sydney.

EW TWO-WAY VISUAL INTERCOM.

E DECCAFAX SYSTEM

new communication system signed to provide instant exange of visual and oral inrmation between remote ints has been developed in gland by Decca Radar Ltd. own as "Deccafax" it can o be used as a broadcast tem with sound and vision be- relayed to any number of dified standard Decca teleion receivers linked in a close circuit.

e simplest arrangement for Dec- consists of two "master" units cted by a low-loss co-axial cable. tures are transmitted by placing parencies over the face of the nitting master unit. The picture is tly relayed and appears on the of the receiving unit. Any marks riting made on the screen of the nitting unit with a chinagraph or with a suitable pen will also layed. The direction of speech and transmission can be reversed by tion of a single switch.

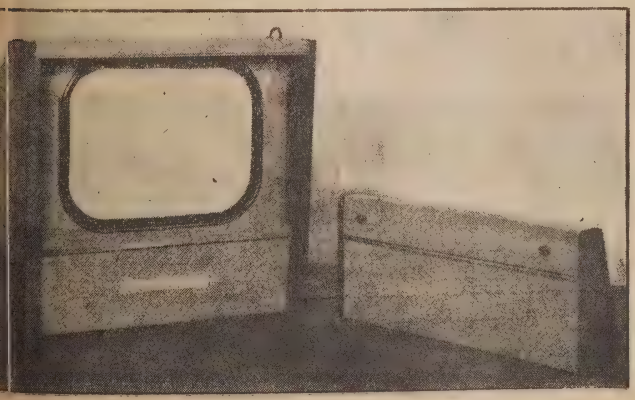
en used for broadcast a single r unit is connected to any number ightly modified Decca television ers, which all receive the trans- l picture. The receivers can still ed for receiving normal programs which can be superimposed mes- transmitted through the master

transmitted picture or message ake many different forms, ranging 35mm. cine film to simple transies. Equipment to move the film ange slides is also available.

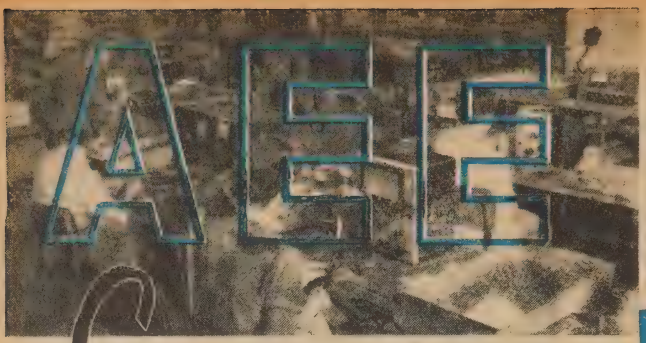
makers claim that the Deccafax system meets the requirements of information collation and filtering at centres where complicated visual displays are necessary.

They instance Air Traffic Control Centres and Defence Operations Rooms, where a number of remote master units could be inter-connected to feed different types of information to a central receiver for enlargement on to a viewing screen. Control can be exercised over the various inputs so that the main display shows only specific information necessary at any one time. Filtering in this way makes it easier for the viewers to appreciate the significance of the events which concern them, the company claims.

Production model Master Unit. The sound element is not shown but would be fitted to the front. If the hood element containing the photomultiplier is detached, the remaining part is the monitor or receiver element only.



The monitor or receiver element (left) and the sound unit (right) for the Deccafax picture transmission system.



Serving **THE AUSTRALIAN RADIO-ELECTRICAL INDUSTRY**

in the development and production of high quality Capacitors for use in a wide range of Electric, Radio and Television equipment.

"Microcap" Miniature Metallised Paper Capacitors.

"Microcap" Moulded Metallised Paper Capacitors.

Moulded Foil & Paper Tubular Capacitors.

Fluorescent Power Factor Capacitors.

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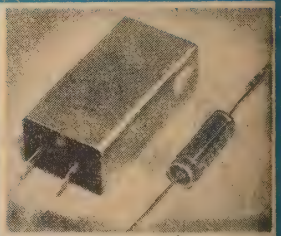

Capacitors for Telecommunications.

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Agents in all States.

The Deccafax system has many other
plications, including the reversal of
otographic negatives to be displayed
positives, the superimposing of sev-
l pictures onto a single viewing
een and the showing of private films
thout the noise of a portable pro-
tor and without any need for total
rkness.

The equipment is based on a flying
ot scanning principle. In its simplest
m picture transmission is obtained
placing a 10 in x 8 in transparency
the surface of a 14in cathode ray
e where a blank television raster
being produced.

A photomultiplier is mounted in a
od above the transparency and col-
ts light passing through the trans-
rency from the CRT source. The
nal from the photomultiplier varies
ording to the information or picture
the transparency. After amplification
is fed to the receiving station by
axial cable. This signal modulates
raster on the receiver, producing a
simile.

eccafax' Specifications:
Mains voltage: 230 v 50 c/s plus or
nus 10 per cent.

Consumption: Monitor or receiver
y, 160 watts. Master unit (Tx and
) 165 watts.

Dimensions: Monitor or receiver only
front to back 19in, height 17¼in,
idth 20in.

Transmitter: front to back 34in.

Trolley unit: height to screen centre
3in. Screen angle (from horizontal) 30
grees. Base of trolley 19in x 22in.

Weights: Monitor only 62¼lb. Hood
gh photomultiplier 10½lb. Sound box
8lb. Trolley (With wheels) 19¼lb.

X-RAYS CHECK FROZEN FRUIT

A POTENTIALLY practical method for detecting frost damage in citrus fits is in experimental use at the Uni-sity of California, Los Angeles.

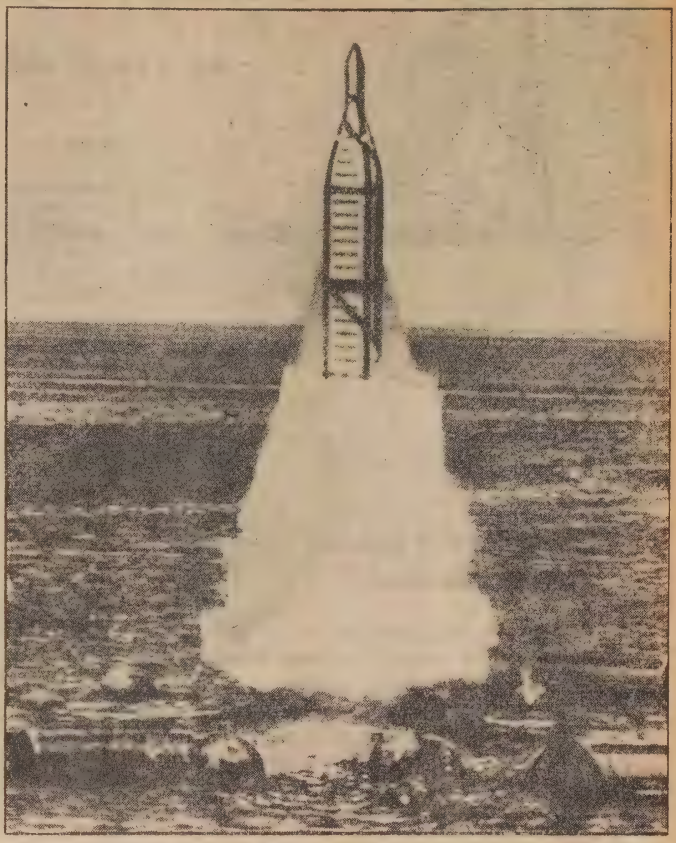
X-rays are beamed through fruit rating on a platform. Resistance to l X-rays is measured as a voltage, hich increases in proportion to the non-iformity of the fruit. Non-uniformity o fruit sections indicates frost damage

The machine was designed by William T Kyle, who heads the university's Cen-l Electronics Facility, and Joseph E. Mateer. Kyle thinks a commercial odel handling 10 units of fruit a second ould cost between 10,000 and 20,000 dlars.

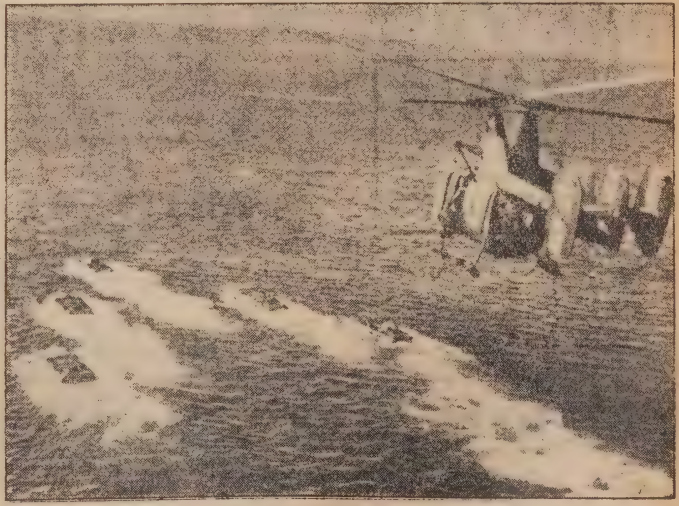
Speed of the prototype is three or fr units of fruit a minute. A com-rcial model would include devices for channelling the fruit into the detector a for rejecting bad fruit.

light—These landing barges are being perated from the helicopter which, by adio control, can steer and manoeuvre hem into position. Push buttons can top and start the engines, and a type f steering stick is used for navigation. he barges can also be controlled in-dividually in the normal manner.

MENACE FROM OUT OF THE SEA



The latest weapon to be used with submarine warfare is a guided missile which can be fired from beneath the surface. This picture shows the "Polaris" missile clearing the water during a test firing from a test bed.



A CHAIN IS ONLY AS STRONG AS ITS WEAKEST LINK

How wise, An old saying needing no explanation. Yet how applicable to so many aspects of our everyday existence. Television for instance! From camera to viewing room the television picture passes through countless complex phases, each one dependent on the other. Transmitter, aerials, receivers, operating in conjunction for a common objective —if one fails the chain is broken. It is wise to use only the best, and the best is the product backed by research, experience and sound reputation.

The Antiference Link is stronger than ever!

In their 1958 Snapfast range Antiference are exhibiting the finest television aerials in the world. In this fully comprehensive range of top-quality, top-performing aerials are seen new features which again justify Antiference's world leading position. How can Antiference take such forward steps as the new Snapfast assembly method, time and time again? By research in laboratories and in the field, by drawing on the vast reserves of experience and technical know-how which have kept Antiference at the top for 22 years.

Faster assembly with the new Snapfast method

Antiference TV Aerials are available from your usual wholesaler or:

ANTIFERENCE
(AUST.) PTY. LTD.
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VIC.: 360 Smith Street, Collingwood
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'Phones: MX 1104, MX 1197, MX 2314

THE WORLD'S AND AUSTRALIA'S LARGEST TELEVISION AERIAL MANUFACTR
AF

CA ANNOUNCES NEW STYLE APE MAGAZINE

Plus Stereo Discs

new plastic tape cartridge nounced by RCA may herald new era for tape in the home. is extract from the Chicago ily News shows how seriously mestic stereo is regarded in America.

REOPHONIC sound from low-riced magazine loaded tape versus phonic sound from long playing ds. That is the next major battle fought in the home music field. dio Corp. of America demonstrat-new contenders in both fields be-500 Mid-western dealers at the n Street Theatre.

retofore stereophonic sound for entertainment has been available pe, but a reel has run from 10 s to 20 dollars, too high to achieve public acceptance. This Spring d radio and high hi-fidelity manu-ers have shown machines that will iew type stereo records, priced from 4 dollars to 6 dollars for a 12in play.

★ ★ ★

W THE PICTURE has been com-ed with arrival of R.C.A.'s new tape ine. This mounts a ¼in magnetic with two spools in five-by-seven-artridge. It slips on and off two es just about as easily as a record off its spindle.

¼in tape carries four sound tracks d of two that are found on the us ¼in stereophonic tapes.

operation the tape player would e itself at the end of a tape and ack, playing the other two tracks. a monaural recording it would e tape length four times. Prices R.C.A. range from 4 dollars 95 for 22 minutes of stereophonic g time to 9 dollars 95 cents for inutes.

le records tend to lose quality and out from usage, tape supposedly virtually no sign of wear and does ed replacement after a year or

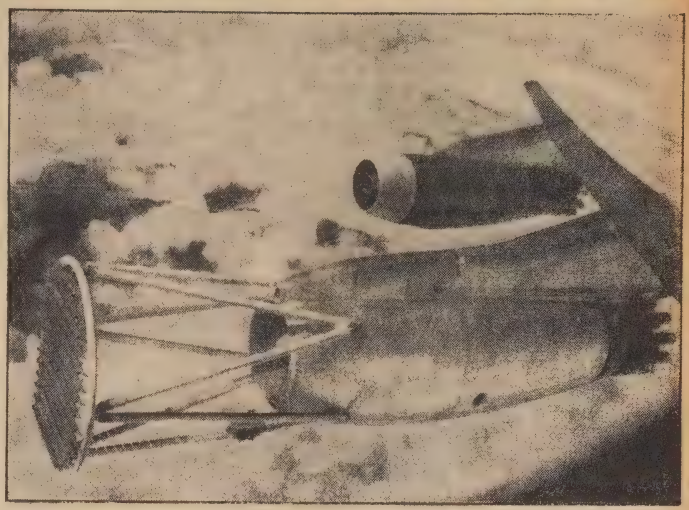
★ ★ ★

HOME MUSIC lover also can his own tapes from somebody pre-recorded tape or a record. But nnot cut his own records. The our-track tapes can be recorded stereophonically or monaurally.

its new line of record players, .. will switch completely to the ereophonic type equipment, aban-completely the old type needles ickup that were suited to the rally cut record.

new type ceramic pickup (needle artridge) demonstrated by R.C.A. lay both the present type 33 hi-fidelity records and its new type 33 r.p.m. records.

MAN-MADE ICE TESTS ENGINES



In order to test a new de-icing device, Boeing Aircraft Company dreamed up the ice-producer seen here ahead of a jet engine on a type 707 airliner. Water sprayed from the "venetian blind" of 14 parallel bars carrying 109 nozzles formed ice at will at high altitudes and clear conditions. Valuable safety information was obtained as a result.

'RIPPLE' COLOUR ON CLEAR FILM

A colourless, transparent slide produced a full-colour photograph when projected on a screen during a demonstration at a recent meeting of the Optical Society of America. It uses a new technique for recording "colour information" in tiny ripples on a clear gelatin film.

THE new colour projection technique may have eventual importance in colour television for both home and theatre applications. It might also be adapted to projection TV systems, making possible simultaneous projection of primary colours in perfect register on the screen.

The ripples in the film serve as a diffraction-grating system, and a special projector is used to "Translate" the diffraction patterns — overlapping series of light waves—so that brilliant primary colours are projected on the screen at the same time. The slides were in the standard 2 x 2 size, and because the diffraction ripples were only a thousandth of an inch apart, the projected picture had a resolution—sharpness—comparable to a good TV picture.

BLACK & WHITE FILM

The colour information can be recorded on black-and-white film, so that an ordinary-appearing black-and-white slide produces a full-colour picture on the screen. By placing a special mask in front of the film in an ordinary camera, colour photographs can be taken directly on black-and-white negative materials. (The diffraction-grating system produces a "positive" colour picture if the monochrome slide is either positive or negative.) The technique has not yet been developed for wide use in photographs, it is primarily intended to apply the idea to television.

An unusual aspect of the system is that it makes possible a full-colour picture produced by two primary colours, one fixed and one variable, instead of the usual system of three fixed primaries. The "one-fixed-and-one-variable" method actually reproduces a greater part of the visible spectrum than the ordinary three-primary system.

PRINTED ON GELATIN

The diffraction-grating ripples are printed on chromated gelatin. The black-and-white "colour slides" utilises fine-grain photographic film. It was suggested that the Swiss Eidophor system for black-and-white TV projection, in which diffraction gratings are written on to an oil film by an electron beam, might be modified for simultaneous colour projection using the new technique.

Possible advantages of the new system in colour television would include high brightness, perfect colour register, and greater simplicity than colour-TV systems now in use. But it was emphasised that, so far, the product was a laboratory achievement and not ready for the market.

Typical samples used for measurement. Left foreground, rope sandal from Fort Rock Cove, Oregon, 9,000 years old. Left rear, 2,0 year-old rope from Peru. Right rear, 2,000-year-old cotton cloth from Peru. Right foreground, 10,000-year-old faeces of extir giant ground sloth (Northrotherium shastense) from Gypsum Cove, Nevada.

Setting The Age Of Ancient Things

In an attempt to estimate the age of the universe and living things scientists have develope some interesting techniques, which our contributor sets out to explain in this article.

by Calvin Walters

Some of these techniques are reasonably accurate, some not so accurate.

In 1946 Howard Shapley of the University of Cambridge in Massachusetts U.S.A. remarked that astronomers and geologists who have worked assiduously during the past half century on the theory of the origin of the earth have reason to be satisfied with themselves, because they have produced so many hypotheses that do not work.

His argument of course is that these workers, by finding the hypotheses that do not work, by showing what is not so, "have cleared the way for more competent investigations and indicated in what direction profitable astronomical and mathematical researches lie."

During my browsing through a multitude of scientific journals I am amazed at the diverse subjects which scientists tackle. If you wish to be dazzled with all sorts of subjects, get hold of the Annual Report of the Smithsonian Institution of Washington.

Take for instance the "LIFE HISTORY OF THE QUETZAL." Are you interested in Quetzals? Is it a grub, animal or bird? It turns out to be a beautiful bird of Central America and the article tells of its environment, appearance, habits and voice, nest eggs and incubation and how to care of the young.

Then there is the "Life histor Whalebone whales" "Palestinian tery in Bible times," "The sex lif an ant," "The jump of a grasshop and the "Development of cactus thr

Now, no matter what subject is dealt with, one often finds that mention is made of the probable l of time that whatever is being t about has been in existence.

Thus all scientists are interest time and anything which leads to mation of this all important factor great value to them.

As I mentioned in one of my vious articles on archeology, the mation of age of "finds" in years past has been a fairly haphazard We laymen have always been a about the way archeologists have "; the toss" about the age of a l knee-cap dug out of a ditch. First thousand million years old, next is down to a million, next week one hundred thousand and so on

A classic example of all this of the famous Piltdown Man. Th ancient inhabitant of Britain wh mains had been found was the come Man. Part of a skull of t chappie was dug up and, by com with the geological formations in he was found, it was estimated lived about 300,000 years B.C.

RADIO CARBON TEST IS ACCURATE

ome years ago someone dug up an- r skull at Piltdown. This caused t excitement for, by comparing it the geological formations and other es and relics among which it was d it was estimated that this Pilt n cove roamed the countryside of ain about 500,000 years ago thus ing the Swanscome cove out of the ure as being the oldest "English- n."

or a while Piltdown kept his status l some interfering busybody started apply modern techniques to the es. He used dental drills and drilled some of the bone for chemical an- is.

he tests applied were mainly the rine and nitrogen tests.

hese were mentioned in my previous le on archeology but it is interest- to go into the matter in more de- so that my readers (if any) can get e idea of how the scheme works

he fluorine test will not give an olute date to bones. It will show ther bones found mixed together in one place are all of the same age whether they are of various ages have become mixed by flood, pre- s excavations or a deliberate "plant." latter is important as will be seen.

FLUORINE CONTENT

he gaseous element fluorine is pres- in minute quantities in ground er. Any bones in contact with this er will absorb the fluorine and the ger they are there the more fluorine ly will absorb.

f therefore, several bones are dug in the one place and they are all nd to contain the same amount of rine, it is a safe bet that they are of the same age. So that if the gological age of the deposits in which y are found is known, then that is so the age of the bones.

On the other hand if some bones ntain less or more than others, then they are older or younger than each other and must have become mixed.

In bones discovered in deposits 100,000 years old, it was found by improved techniques in 1953 that they contained 0.1 per cent fluorine. This amount was also found in the skull of the Piltdown Man indicating that he could not be older than 100,000 years.

This is not a bad old age but he was certainly not 500,000 years old and that was the important point at this stage.

Now here is where the "monkey business" crept into the picture. When tests were applied to the jaw bone of Mr Piltdown, the bone contained only 0.04 per cent fluorine. Strangely enough this is very close to the amount found in the bones of a fairly modern chimpanzee. It looked suspiciously like someone had played a joke on the anthropologists.

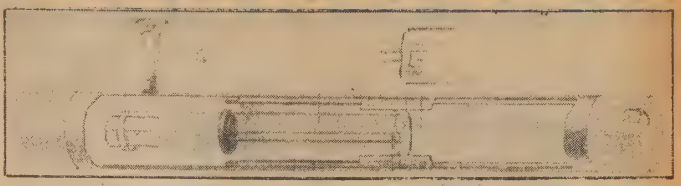
For confirmation resort was had to another more recent test. When buried bones get old they gradually lose their nitrogen content in proportion to their age. The oldest have less than the more recent.

When this test was applied to old man Piltdown, who by this time was beginning to appear not as old as he looked, the skull was found to contain approximately one per cent of nitrogen compared with about 0.7 per cent in bones about 100,000 years old. Therefore Piltdown was less than 100,000 years old. The jawbone however contained 3.9 per cent nitrogen compared with 4.1 per cent in a fresh jawbone.

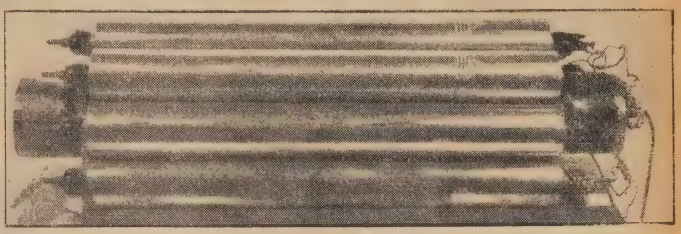
THE PILTDOWN JOKE

The secret was out. Old Piltdown was a fraud and a fake. He had been assembled from bits and pieces of human and monkey and been planted among various ancient implements and bones in ancient deposits. Even these implements and fossilized animal remains were subjected to the tests and were proved to have been artificially coloured to match up with the earth and gravel in which they were found.

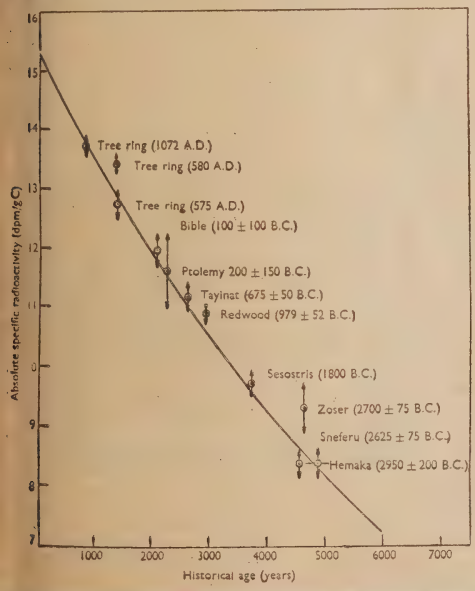
Thus it was that a great piece of de-



Screen-wall counter. The sample in the form of elementary carbon is disposed around the inside surface of a movable cylinder surrounding a grid, defining the sensitive Geiger counter volume. The two possible positions of the cylinder correspond to the carbon sample being alternately over the grid and removed from it, so the difference in counting-rate is a direct measure of the radiocarbon activity.



Side view of the screen-wall counter surrounded by the shielding counters used to cancel out the penetrating cosmic rays. The box contains four counters underneath, making a total of eleven.



Samples of known age. The solid curve is calculated from the assay for modern wood and the laboratory measurement of the half-life of radiocarbon. The individual points are specific radioactivities of various pieces of organic matter, principally of wood of known age. The errors indicated are the standard deviations (which ensure 2 out of the 3 chances) and are calculated solely on the basis of the number of counts taken; they do not include any other errors, such as that arising from contamination.

TRANSISTOR OC16

Dissipation 14 watts at 45°C*

INDUSTRIAL APPLICATIONS

This high output germanium junction P.N.P. power transistor is being used to great advantage in the following applications:

Class A and B Audio Amplification

Aircraft Passenger Address Systems

D.C. Converters

Power Amplifiers for Servo Motors

Power for Relay Operation.

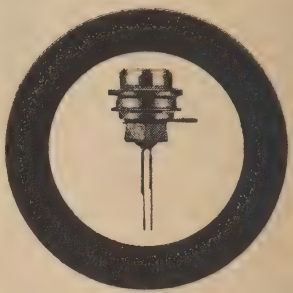
FEATURES

Peak current 3 amps.

Maximum mean current 1.5 amps with good current linearity.

Maximum continuous junction temperature 75°C. Up to 90°C. for intermittent operation (total duration 200 hours max.).

A pair of OC16's operating in Class B push-pull will provide an output in excess of 10 watts into loudspeakers with 12 volts "H.T."



Half actual size

DATA

Characteristics (measured at 25°C ambient)

Collector reverse leakage current, grounded base ..... <100μA

Current amplification

at Ic = 30mA 40
at Ic = 300mA 35
at Ic = 2A 22
at Ic = 3A 16

AMBIENT TEMP. (TO GIVE 75°C JUNCTION TEMP.)	DISSIPATION WITH INFINITE HEAT SINK, e.g. —WATER COOLED	DISSIPATION WITH LARGE METAL PLATE 1 C PER W THERMAL RESISTANCE	DISSIPATION WITH 1 sq. ft. METAL PLATE 2·C PER W THERMAL RESISTANCE	DISSIPATION WITH SMALL METAL PLATE (4 in. x 7 in.) 5.5° C PER W THERMAL RESISTANCE
25°C	45W†	24W	16W	7.6W
35°C	36W†	19W	13W	6.1W
45°C	27W†	14W	9.7W	4.6W
55°C	18W	9.5W	6.5W	3.0W

† *Continuous dissipation values in excess of 24W are at present prohibited by the voltage and current ratings given in the full data.*

*** POWER DISSIPATION**

14 watts dissipation at an ambient temperature of 45°C can be allowed when the OC16 is bolted to a large but practical heat sink. The accompanying table shows allowable dissipations with difference heat sinks. In all cases the transistor is mounted directly on to a plate with a thin tin-plated lead washer. When electrical insulating mica washers are used, the dissipation is somewhat reduced. Full data is available.

Mullard

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592 Bourke Street, Melbourne. MU2366
Associated with Mullard Limited, London
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Mullard

COMMUNICATIONS AND INDUSTRIAL VALVE DEPARTMENT

M61

ive work was brought to a sat-
ory (or unsatisfactory according to
viewpoint) conclusion. Mr Piltdown
thrown from his pedestal as being
oldest known Englishman. It has
er been clearly established who per-
ated the fraud, but he certainly pro-
ed some red faces among the
heologist of that time.

robably the most useful tool to the
heologist for the purpose of dating
nd is the method known as "Radio-
on Dating." This is based on the
ount of radioactive carbon or Car-
14 found in remains. It is called
for short.

he reasoning behind the radioactive
on method is a little complex for an
cle of this nature but it is essential
well as interesting to know a little
why such schemes work. I will thus
and give a simple dissertation of
principles involved and Heaven help
from here on.

OSMIC RAYS

he earth is being continually bom-
ded with cosmic rays of unknown
in. The rays cause the production
neutrons by disintegrating atoms of

Geiger counters sent up in balloons
eal that the intensity of neutrons
s up to a height of 50,000 feet then
s off sharply. It appears that the
utrons are not present initially in the
mic rays but must be produced by
rays' action on the air.

his is also borne out by the fact
t neutrons are unstable and have a
f life of only 13 minutes. They would
refore not live long enough to reach
earth from far outer space.

t has been shown that neutrons are
oduced at a rate of 2.4 neutrons per
are centimetre of the earth's surface
ry second.

he neutrons produced by cosmic rays
er reach the earth's surface. There-
e they must be absorbed somehow in
atmosphere.

Oxygen is inert to neutrons but nitro-
has a strong interaction. The neut-
is interact with nitrogen to give hyd-
en and carbon 14 (radioactive car-
n). The formula for those who are
mically minded is n plus N14 equals
plus C14.

ADIOCARBON HALF-LIFE

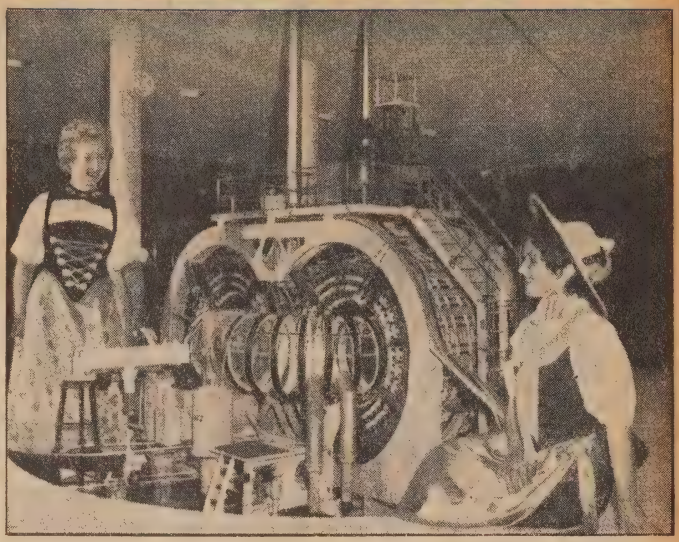
It is thus concluded (don't ask me
w) that 2.4 atoms of radiocarbon are
oduced every second for each square
timetre of the earth's surface at the
sent time.

Now radiocarbon has a half life of
568 years or 8,030 years average life,
d notwithstanding the vast number
years that radiocarbon has been gene-
red this rate of generation must be
ual to the rate of disintegration, other-
se the radiocarbon content would con-
tently increase or decrease. Therefore
balance must somehow be maintained.

Carbon atoms are formed at a dis-
nce of some 6 or 7 miles above the
rth. These carbon atoms burn in the
to form carbon dioxide and the cos-
ic rays act upon them and radioactive
rbon dioxide is introduced into the
mosphere and distributed by the winds
d other forces.

All atmospheric carbon dioxide is
ntaminated with C14 at the rate of

ZETA MADE AUSTRALIAN FAMOUS



At the recent Brussels International Fair, Britain had this fine model of ZETA on display. ZETA is the Zero Energy Thermonuclear Assembly, a device for research into the harnessing of power through nuclear fission which leads scientists to believe that the oceans of the world will eventually become an inexhaustible source of power. It was the work of famous Australian, Dr. Peter Thoneman.

2.4 atoms of C14 every second for each square foot of the earth's surface. Plants absorb carbon dioxide and therefore some of the radioactive carbon dioxide. Animals live on plant life and therefore absorb some also from the plants. The carbonates and bicarbonates and all inorganic carboniferous materials in the sea which have contact with the carbon dioxide of the air must all contain radiocarbon.

The production of radiocarbon and its disintegration are exactly balanced. Knowing the life of radiocarbon and the number of atoms produced per second over the earth's surface, together with the number of disintegrations taking place, scientists have arrived at a formula which enables them to calculate what is called the specific activity of living matter.

There is always a ratio of radiocarbon to ordinary carbon in all living matter and this ratio is constant for all living things which exchange carbon with the atmosphere, notably in the form of carbon dioxide.

EXCHANGE CEASES

Now when a thing dies, this exchange naturally ceases and the radiocarbon content decreases by disintegration at the known rate while the content of ordinary carbon remains constant.

There is thus a constant decrease in the ratio of radiocarbon to ordinary carbon at a steady and immutable rate.

As radiocarbon has a half life of 5,568 years it follows that a bone or piece of cloth or the remains of a mummified body of that age would exhibit half the specific radioactivity of present day living matter. Comparative test on material 5,000 years old, the oldest material available of that known age, confirms the accuracy of the radiocarbon method of dating.

Thus the radiocarbon content of dead matter reveals the age of the material since death. It could not reveal the age since birth because it is only after death that the radiocarbon—carbon ratio begins to alter.

Because the radiocarbon content of specimens is so minute special instruments had to be devised in order to avoid errors of measurement caused by the action of cosmic rays and the radioactivity which is often present in most substances.

GREAT IMPORTANCE

In the hands of the archeologist this method of dating "finds" is of extreme importance. Interesting experiments have been carried out with specimens of known age such as tree trunks where the annular rings disclose the age of the tree.

The results have been a startling confirmation of the radiocarbon method of dating. In most cases the method disclosed a discrepancy of only a few years in thousands between the "known" age and that disclosed by radiocarbon dating. A few years or even a few hundred is nothing much to the archeologist and at least is better than the past guess work which often gave discrepancies of hundreds of thousands of years.

Dating has taken place of such items as the trunks of sequoia trees which are the oldest trees known. The annular

(Continued on Page 124)

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New Philips tape recorder now released. 3 speed, fully press-button operated. £165

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Technical Review

RADAR TRACKING METHODS MEET SPACE CHALLENGE

low does one meet the space challenge? By getting a ostile ICBM before it gets you. It is being tackled by ex- ending radar range, shortening response time, increasing iscrimination It uses brute force together with all the tricks of electronics, physics and statistics.

l is a commentary on the march of r ess that, while prior to the last a it was England who was concentra- n on radar warning devices to give e of German attacks, the United s is today in much the same posi- o

itain's problem now isn't so much a ing as immediate countermeasures i retaliative weapons. Her shores are e dotted with missile bases where n they carried radars, although nat- y radar warning is in use as well.

d, with the acknowledged advances chnology made in recent years by ia, particularly in the missile and lite field, there is quite a search- g on the activities of the U.S.A. y and Army research to discover t is being done about it.

cording to "Electronics," people n to be angry with radar research be- e the earth is round and radio energy els more or less in straight lines. The rtant thing to remember is that every pon has a counterweapon.

RNING IN TIME

he discussion concerns the problem detecting ballistic missiles by radar ime to do something constructive— ather, destructive—about them. This icular pot has been boiling since the iet Union announced it had an inter tinental missile.

When the DEW-line radars began peer- across the Pole at probable sources air penetration, everybody felt good. se sets are over 1,000 miles from the . border, with better than 200-mile ge. They give Strategic Air Com- d something like two hours to mble.

low the movement is against enemy siles. Early last month R.C.A. was n a management contract for a bal- c-missile early-warning system M.E.W.S.). General Electric will build radars and Sylvania will build the putation-presentation system.

he radar is a sophistication of a nster installation that was installed e four years ago down on the Rio nde. This prototype looks almost 500 es to the north-west, watching the siles come and go at Holloman A.F.B l White Sands. It has given valuable information on how to design an early warning system against ballistic missiles.

B.M.E.W.S. will not replace the DEW-line. The detection and location of aircraft and missiles present two different sets of problems. DEW-line will continue to guard against aircraft; B.M.E.W.S. will watch for missiles rising as much as 3,000 miles away. Both will work into the SAGE system.

For ballistic missile work, researchers are not interested in seeing much beyond 3,000 miles. The reason: at this distance a radar pointed horizontally is looking at a point 1,000 miles or more above the surface.

B.M.E.W.S. will be installed within two years. Design work is finished; it remains only to do the final engineering and tool-up to make the sets.

The system will use some brute force and a lot of sophistication to reach targets 3,000 miles away. It will have a peak power of 7-10 megawatts and work into an antenna system with a toroid-section reflector more than 300ft high.

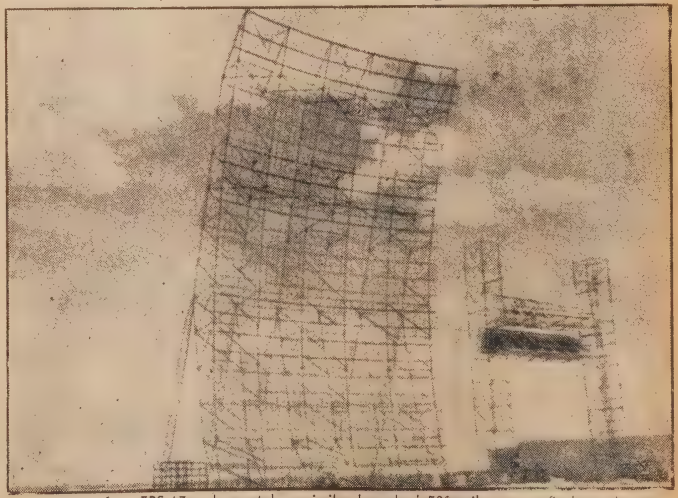
Frequency diversity will find some use in ultra-long-range radars like B.M.E.W.S. This technique sends simultaneous pulses out on different frequencies. Since the straightness or curvature of a radio wave's path through the atmosphere is a function of frequency, the pulses go and return on slightly different routes and are combined when they return. If atmospheric conditions garble or fade one signal, the other usually gets through.

SEVERAL ADVANTAGES

Multi-frequency transmissions may also be used to increase average power while still keeping maximum range. The set will divide the maximum-range waiting time into several parts; a single scan will be made up of several pulses. One pulse will go out on one frequency and a receiver preamplifier tuned to that frequency will wait the full maximum-range waiting time.

Meanwhile, other pulses on other frequencies will go out at fixed intervals, with other preamps waiting the full time. A synchronised combiner will mix the signals before sending them to the presentation system.

Besides increasing average power without cutting down range, this multi-fre-



Antenna of an FPS-17 radar watches missiles launched 500 miles away. Radar antennas for Ballistic Missile Early Warning System (BMEWS) will be twice as big as this 110 by 165ft monster. This is just one way that radar will meet the space challenge.

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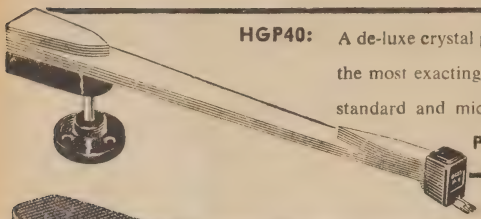
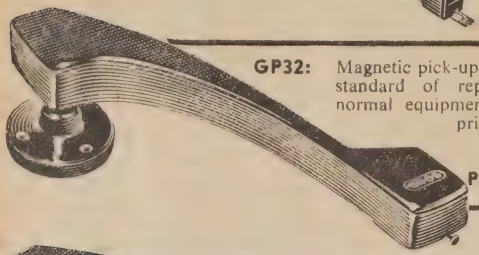
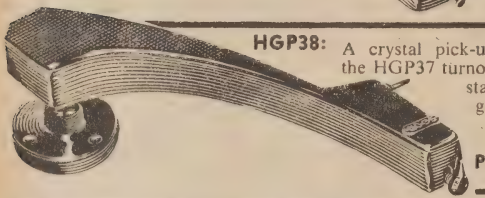


HGP40: A de-luxe crystal pick-up to satisfy the most exacting. Complete with standard and microgroove heads **PRICE, £9/15/-**



GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, ½ volt at 1,000 c.p.s. **PRICE, £2/12/6**



HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus **PRICE, £5/15/-**

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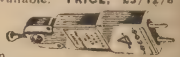

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gy technique will sharply reduce the
e that a fast-flying object can cut
s a tight radar beam between pulses
o escape notice.
rly radars relied on human opera
to capture, locate, track and take
on targets. Gradually the radar it-
nas taken over all these functions
ne; the initial location and recog-
i of a blip as a target. BMEWS
lo even this.
st, moving-target indicator tech
s will cancel out ground return and
clutter. MTIs are pretty good now.
can still be improved, but coherent
, are quite reliable and adequte.

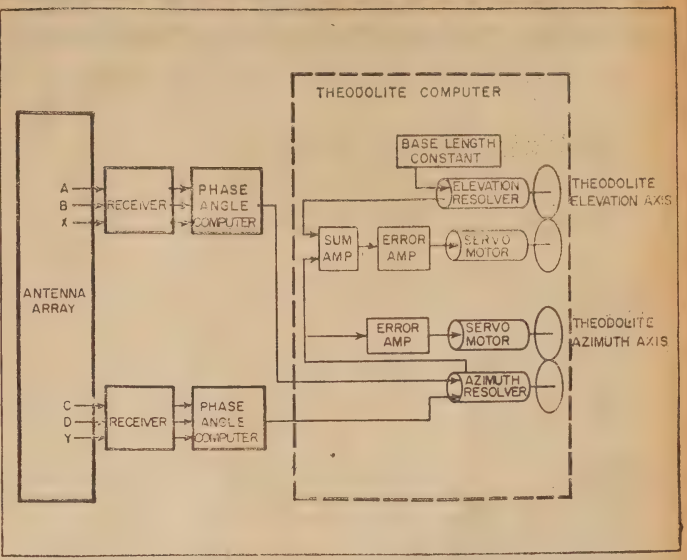
ACHING THE COMPUTER"

e computation-presentation system
be "taught" the echo pattern of a
ballistic missile. It will compare
mation returning from each scan
st its recorded pattern. The first
an unpredicted echo returns, the
uter will use its learned rise pat-
to figure out where the next echo
d be by the Monte Carlo method.
statistical technique is used to pre-
where a moving particle will next
ar on the basis of little or no infor-
on about its previous behaviour.
ch new echo will confirm or correct
rediction. On the basis of very few
ns—half a dozen or so, amount-
a about a second of time—the com-
will be able to begin predicting
of probable impact. Each subse-
t echo will correct the prediction.
ithin the next few seconds, course
be extrapolated to point of impact
the warning will go out. BMEWS
then plot an intercept course and
ide data to direct countermissiles.
sides BMEWS, there are a lot of
moves in the radar game.
oherent systems permit radar opera-
to figure out velocity of the target
neasuring the Doppler shift between
and echo. Part of the transmitted
is used to stabilise the local oscil-
to a fixed difference from trans-
r frequency.
lid-state supercooled masers will in-
se receiver sensitivity by perhaps as
h as 10 db. This will enable radar-
ers to cut down on power while still
hing far out.
ew klystrons provide higher power
uts and far greater frequency stabil-
han magnetrons. More stable power
lies are among other evolutionary
lopments.

WER FREQUENCIES

ower frequencies will accomplish two
gs. First, longer waves bend in the
osphere, may give radarmen a little
r view of the horizon. Secondly,
're more likely to encounter "wave-
th-size" objects, which return strong
es. In Bath, Me., a 200-mc set with
20ft scanning reflector has been pick-
up beautiful echoes from objects
ds long for a couple of years.
ransmission lines are being improved.
en Cornell Aeronautical Laboratory
eeded in getting 21 megawatts on
air last month, the trick was in the
smission lines. CAL's system uses
nagnetron driving a Stanford linear-
elerator-type klystron; this arrange-
it has produced peak power levels as
as 21 megawatts before. CAL
naged to get 2-microsecond pulses of
peak power from the klystron to an
reflector at a pulse rep rate of 60
second without arcing or burning
the line.

COMPUTERS GIVE NEW ACCURACY



Analog computers permit replacing complicated scanning dish antennas with simple vertical whips in a new electronic missile acquisition system, EMA II.

The computers, built by Magnetic Amplifiers, U.S.A., compare the phase of radio signals received from the missile. They put out position and error signals that make the optical theodolite with its motion-picture camera follow the missile in flight.

The Army is now testing the first EMA II system at Aberdeen Proving Ground. It is expected the system's overall accuracy will be 0.5 degree in both azimuth and elevation. A signal with a strength as low as two microvolts at the antenna will insure accurate and continuous tracking.

Complete system consists of an antenna array, two special radio receivers, three analog computers and the theodolite. Also required is a 74-megacycle beacon transmitter in the missile.

CUTTING COST OF COLOUR TV PROGRAMMES

Details of a new device which inserts backgrounds for shows by using slides and film on a two-camera system. An ingenious method of colour triggering is used to achieve correct superimposition.

A recent development of interest to colour TV broadcasters is being discussed by the National Association of Broadcasters convention in Los Angeles.

The device, Chroma Key, takes images picked up by two television colour cameras simultaneously, and combines them into a composite picture. With this technique, actors on a bare stage will appear against scenic backgrounds provided by colour photos, movie film strips, or miniature sets.

The device costs about 750 dollars. There are no current plans for merchandising at this time, but such plans may materialise later when design and production figures, as well as applications, are thoroughly appreciated.

The system uses two cameras. The first picks up the performer before a solid colour background. The second picks up the scenery. Both camera outputs are routed through the unit where the performer's image is "etched out" electronically and inserted in the scenery picture.

This effect is produced by having the solid colour background trigger the scenery camera. During the interval when the live camera is scanning the actor, the scenery camera is turned off automatically in association with the special effects amplifier.

Actors must not wear clothing the same colour as the background screen because the scanning action will key in the scenery whenever it encounters this colour. An actor wearing a blue tie before a solid blue background, for example, will appear to have a tie-shaped hole in his body through which the background will be visible.

The device was first used on colourcasts in Hollywood. Chicago and New York stations are now equipped with the new device.

The effects do not require colour receivers for successful viewing, but are picked up equally well by black-and-white sets.

The WARBURTON FRANKI Page

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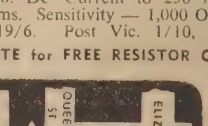

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I.S. satellite has 3oz. transmitter

iture U.S. satellites can continue dcasting outer space data to earth o 4 times as long as is presently ble. as a result of the develop- of a new transmitter by engineers ie DuKane Corp., St. Charles, Ill., r contract to the U.S. Naval Re- ch Laboratory.

ie transmitter was developed as a milliwatt version of NRL's 100 satellite transmitter. In designing new transmitter the engineers eved a better efficiency as well as desired power level. Although the it works well, months of exten- development and testing will be ired before it can be programmed an actual satellite or missile

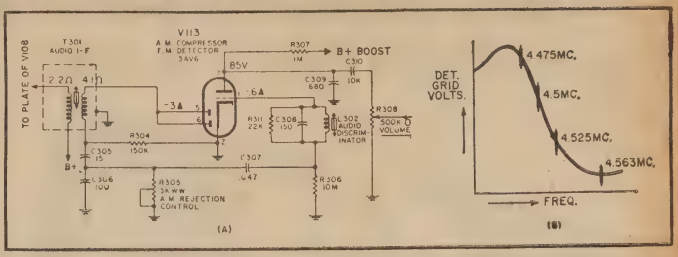
ie crystal-controlled transmitter loys three recently developed tern Electric transistors capable perating as oscillators or ampli- at 108 mc. The special circuits loyed give much greater overall iency than is now possible with ium tubes. A comparable tube trans- er requires five times the battery er needed by the transistor version.

IGHT IMPORTANT

satellite programs, this means a ly significant saving in weight, since r batteries can do the same amount work. Or, using the same batteries, satellite transmitter can broadcast a much longer period of time.

he tiny "broadcasting station" weighs than 3 ounces and occupies less 6 cubic inches of space (a ciga- package occupies about 7 cu. in.). ypically, the output stage of a con- ional tube-type transmitter doing same job would need 4,620 mw. er to produce 500 mw. output. By trast, the output stage of the new smitter needs only 930 mw. power oduce the same output. The cor- onding efficiencies are 11 per cent 54 per cent. The new circuit opera- on a single 20- to 24-volt battery.

A New G-E FM Detector



(A) The limiter-detector-amplifier circuit. (B) Grid-circuit reponse.

Since the introduction of the original gated-beam FM detector (6BN6, etc.), TV receiver and tube manufacturers have been devoting considerable attention to streamlining the sound section of the TV set. As a result, we now have more than one way, within the limits of a single tube envelope, of detecting the FM i.f. signal and bringing it up to a sufficient level so that it may feed a high-sensitivity output tube directly

This reduces the entire separate sound section to no more than three tubes and, in cases where the intercarrier signal feeds the detector directly without an i.f. amplifier, to only two tubes.

The newest practical technique for accomplishing this goal is the so-called "Delta Sound System," used in the new General Electric Q3 receivers. Actually, this method relates to slope detection, one of the earliest and simplest techniques for recovering audio signal from an FM carrier. The basis of the method is the conversion of frequency modulation to amplitude modulation. Once this is done, conventional AM detection is all that is needed to produce a usable audio signal.

To achieve the desired conversion, the FM signal is applied to a resonant circuit that is tuned slightly away from the centre carrier frequency. The response of such a circuit is shown in (B) of the diagram. As a result of the offset tuning, the 4.5-mc. carrier actually falls on the slope of the curve.

The TV FM signal is modulated plus-minus 25 kc. above and below the centre carrier. The two extremes of excursion, 4.475 mc. and 4.525 mc., are also marked along the slope shown in (B). Note that the slope is quite linear over the limits of this excursion. Now if we take a signal that is constantly varying in frequency within these limits—as is the FM i.f.—but whose amplitude is uniform, and we apply it to a circuit with the response shown, uniformity of amplitude will be lost.

That is to say, components of this signal that fall below the i.f. in frequency will receive more amplification; while those that are higher in frequency, since they will be farther down the slope, will receive less. Since the slope is linear, we will have amplitude variations that correspond to the original frequency variations. Thus we have our wish—amplitude modulation.

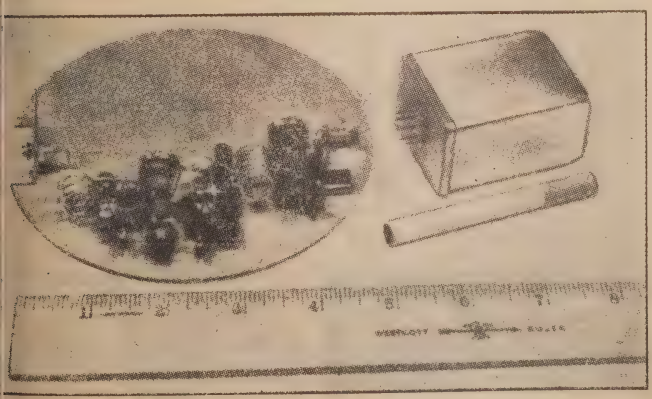
PURE FM

Before performing this conversion, we must make quite certain that the original signal has no amplitude variations, so that the AM we end up with is strictly the result of original frequency modulation.

To get rid of any undesired amplitude changes, the signal, before it is detected along a slope, is fed to a limiter. In the G-E circuit, (A) in the diagram, the audio i.f. is first fed to the plates of diode V113, which act as a compressor or clipper. After most of the AM is eliminated in this circuit, the i.f. is fed through C307 to the tank circuit formed by L302 and C308. This tank is tuned as shown in (B). The AM signal that results then goes to the grid of the triode section.

The triode is so biased that it conducts only on the upper half-cycle of signal fed to it; thus the signal appearing at the triode plate is an amplified and rectified version of the signal at the grid. The audio envelope is recovered by the filtering action of the resistance and capacitance in the plate circuit. These components also provide for the required de-emphasis. As a result, recovered audio appears across the volume control.

Since some original AM remains in the compressed or limited i.f. signal after the action of the diode clipper, it is necessary to feed back some signal from the triode to cancel this residue. R305, which is adjusted for best sound with minimum buzz, controls the amount of feedback applied.



ie tiny transmitter mounted on a circular plate for inclusion in a satellite or missile. A somewhat more compact optional packaging arrangement is on the right

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					Ceramic Length	Resistor Body Diameter
MPF	2 watts	500	20 ohms	1.5 megohms	1·3/4"	5/16"
MPG	4 watts	500	20 ohms	1.5 megohms	2"	9/16"
MPJ	5 watts	1000	35 ohms	3.0 megohms	3"	9/16"
MPP	10 watts	1750	25 ohms	2.5 megohms	4·1/2"	3/4"
MPA	20 watts	2750	35 ohms	4.0 megohms	6·1/2"	1·1/8"
MPO	30 watts	4750	50 ohms	5.0 megohms	10·1/2"	1·1/8"
MPR	90 watts	8500	60 ohms	6.0 megohms	18·1/2"	2"

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   tions in resistance due to humidi
   changes.
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   30 ohms to 10 megohms

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units suitable for high frequency receiv
and similar applications. Resistor bod
is 9-16in by 0.100in (over cups), and th
active resistance section is 3/8in lon

RESISTANCE VALUES: 30 ohms to 10
megohms. **TOLERANCE:** Standard ±20%.
Special ±10%. 5% not available. **POWER
RATING:** ¼ watt, at 40°C. ambient
temperature. **MAXIMUM VOLTAGE
RATING:** 200 volts peak. **CAPACITY
BETWEEN TERMINALS:** 0.015 Micro-
microfarads. **TEMPERATURE COEFFI-
CIENT OF RESISTANCE:** Approx.
—0.04% per degree over temperature
range of —55°C. to +80°C.

TYPE **MP**

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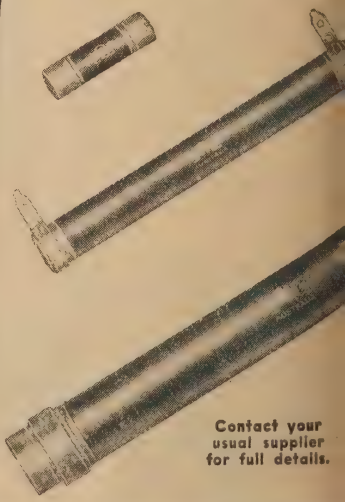

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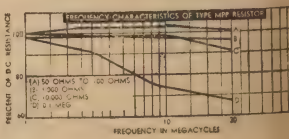


3-D

A New Idea For TV In Color and 3-D

Most people in the TV business agree that developments must continue until one day we are able to see our TV programs in colour and full dimensions. In this article, Milton Sleeper of "Radio & TV News" tells of a new step along the road.

What will our TV sets of the future like? Surely we should not have to ep our eyes glued to a rather small t screen with tiny flat figures on it. st imagine what depth and realism uld come from a large three-dimen- nal coloured image—just like a real- e play right in our own living-rooms. is would not be an optical illusion t real 3-D.

The movie industry has experimented th two methods that can give the usion of depth. In one, two differently loured images are superimposed on the it screen. If the viewer then sees these rough special glasses whose lenses atch the colours of the images, he will e one image with one eye and another age with the other eye. The two sep- te pictures are combined in the mind the viewer to produce a 3-D picture.

OLARISED LIGHT

Another idea is to project one image ith light that is polarised in one direc- on, and project the other image with ght polarised in another direction. gain, special glasses made up of pola- sed light filters could be used to pro- ce the two separate pictures needed r 3-D. With this second method, full- olour pictures can be given depth and alism.

Recently, General Electric has develo- ed the world's first 3-D colour telev- ion system for remote servicing of uclear reactors. This system is strictly closed-circuit setup that is not cur- ntly feasible for the living-room. The chnician who will view the picture will se special polarising glasses like those sed for 3-D movies.

But what about producing a picture that has true depth and does not require special glasses or other illusion techniques? The 3-D display device to be described may provide the answer.

3-D ELECTROFLOR

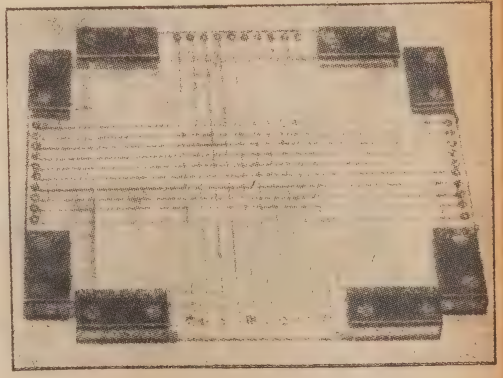
Electroflors are certain new materials that can store electrical energy. When an indicating material is added, the combination will give off light if electrically stimulated by fairly low voltages. Normally the material is crystal-clear. About 50 electroflors are available from such companies as Shannon Luminous Materials Co., Hollywood, Calif. with a variety of colours and storage times.

In practice, a flat glass or plastic plate with a series of tiny holes may be used. A gridwork of fine wires criss-cross each hole, which is filled with the electroflor and sealed. The leads can also be evaporated metal coatings thin enough to remain transparent. With 500 leads on a side and a 25-inch square, definition about equal to a conventional TV picture tube may be had. The plates may be made as large as needed.

By the use of three thin plates sandwiched together, each of which glows with a primary colour, it is possible to produce a full-colour display. Then by stacking a number of such plates together to any desired thickness a true 3-D display is produced. Experimental versions of such displays have already been made. Of course special scanning signals would have to be used to produce a TV-like raster.

Perhaps after we have added colour and depth to our TV of the future, we may want to make the display even more real by adding odours. Can't you smell that sizzling steak now?

☆



Experimental unit made up of two sets of wire electrodes at right angles to each other supported and insulated on a glass plate. Tiny holes at the intersections of the wires are filled with a transparent electroflor and the assembly is sealed. The electroflor will fluoresce and give off light of various colors when electrically stimulated. Any number of these flat plates may be stacked together to produce a true 3-D display device.

HI-FI

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NEWS AND VIEWS OF THE MONTH

ttery Operated art

ELIMINARY experiments have been made with a small electric r and pump which could be left anently inside a person to take over work of the heart.

e experiments were disclosed by University scientist, Dr B. K. Kusv, a research Fellow in the Departof Pathology.

Kusserow said the machine was t seven inches long and two and -quarter inches round and weighed

consists of a small alternating curmotor which gets its power from utside source.

e wire carrying power to it is the connection running outside the

e pump forces out a jet containing t two teaspoonfuls of blood with stroke.

e strokes can be adjusted from 40 80 per minute.

he pump is being tried out on dogs. ongest period of continuous use on g was 10½ hours.

Nylon Arteries

A NYLON blood vessel has been placed successfully into a patient in Shanghai, according to report.

The patient was one suffering from aortostensis—narrowing arteries.

The transplantation was made in a specialised hospital.

After the operation, the condition of the patient improved and symptoms of high-blood pressure in the upper parts of the body and low-blood pressure in the lower parts diminished.

It was the first time an artificial blood vessel had been used on human beings at the hospital.

Fresh arterial vessels taken just after death have been tried previously.

Before the operation took place, 18 experiments were made on animals.

The hospital is now planning to produce Y-shaped and bow-shaped artificial blood vessels to suit different sections of the human system.

U.S. Safety Corridor

IN the U.S.A. a transcontinental superskyway, 40 miles wide and extending from 18,000 to 35,000ft altitude, will be created soon as a safety measure to prevent plane collisions in flight.

There have been tragic collisions in this area, the last being two years ago when there were no survivors from a crash between two airliners.

Tentative plans called for the skyway to be forked at both ends, with terminals at New York and Washington in the east and at San Francisco and Los Angeles in the west.

A 40-mile channel is the first step towards blanket safety control of all planes in the air.

Within the corridor, no aircraft would be permitted to fly without positive control from the ground.

Each pilot flying this super-skyway will be constantly monitored en route and advised of all other aircraft placed ahead of him, behind him, above, below or beside him, even in clear weather.

POPULAR SCIENCE QUIZ

Q.: A great deal has been written about attempts to produce rain when required, particularly in Australia, but have there been any attempts to control other forms of weather?

A.—Yes. In England and on the Continent, particularly in southern Italy, very serious attempts are being made to prevent or minimise hail storms. Such storms are often very severe in these parts of the world and do considerable damage, particularly to fruit crops, such as grapes and other soft varieties.

The most popular approach to the problem so far is the firing of rockets carrying high explosive charges into the storm clouds.

Italy is reported to have nearly 10,000 rocket firing sites, mostly provided by farmers in the southern part of the country, and to fire approximately 100,000 rockets a year. The rockets rise to a height of between 3,000 and 5,000 feet and carry 800 grammes of cheddite.

Until recently there has been little effort to co-ordinate the firing of the rockets or to co-relate any observations of their effect. Now an organisation has been formed to study this problem on a more scientific basis in the vicinity of Verona, an area chosen because of its high incidence of hailstorms.

Q: Are machines replacing manual skills in the time-honoured methods of producing cheeses and other dairy products?

A.—It seems that nothing is safe from the advance of science these days and Australian scientists at the Dairy Research Station have recently announced that two processes previously done by hand since cheddar was first produced more than 3,000 years ago can now be done by machine.

The first was the process of breaking up the curd into small particles as it was separated from the whey. This is now performed by automatic stirrers which rotate, agitate, and lift the curd as they travel the length of the vat, and then release the whey.

The second process, the actual "cheddaring," is an even more delicate one and it was thought that human judgment could never be dispensed with here. However, the problem has been solved, with substantial savings in cost, and an appreciable speeding up of the entire process.

Q: How do doctors and scientists test the wide range of tranquilising drugs now being produced?

A.—This previously presented a serious problem, since use had to be made of human volunteers. Testing effectiveness and determining dosage by this method is a prolonged business if the risk to the volunteer is to be kept to a minimum.

Animals were also tried, the idea being to teach them tricks, then note whether the tranquiliser caused them to forget the trick. This was better, but still presented the problem that not all animals were reliable with their tricks anyway.

The latest system uses cats. They are first trained not to kill mice, by giving them a mild electric shock every time they try to pounce on one introduced into their cages. After a few shocks they become quite neurotic and refuse to have anything to do with mice.

At this stage one dose of a true tranquiliser will remove the neurosis and cause the cat to revert to its natural habit. The neurotic cat thus provides a foolproof basis for comparison of various drugs.

Q: Has science found any practical use for such an apparently "useless" thing as the common house fly?

A.—Yes, and a very important use it is too. Because of the short life cycle, about two weeks, they can be used very profitably for checking various tumour inhibiting chemical compounds produced in the search for drugs to cure or prevent cancer. Reports from America suggest that important tests can now be carried out in three days, only a fraction of the time required to breed and rear suitable strains of rats and mice.

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U or F40/285	"	40	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F40/325	"	40	325/325	" "	Upright or Flat
U or F50/225	"	50	225/225	6.3v/2a	Upright or Flat
U or F60/285	"	60	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F60/325	"	60	325/325	" "	Upright or Flat
U or F60/385	"	60	385/385	" "	Upright or Flat
U or F80/285	"	80	285/285	6.3v/2a 6.3v/2a 5v/2a	Upright or Flat
U or F80/325	"	80	325/325	" " "	Upright or Flat
U or F80/385	"	80	385/385	" " "	Upright or Flat
U or F100/285	"	100	285/285	6.3vct/2a 6.3v/2a 5v/2a	Upright or Flat
U or F100/325	"	100	325/325	" " "	Upright or Flat
U or F100/385	"	100	385/385	6.3vct/2.5a 6.3v/2a 5v/2a	Upright or Flat
U or F125/285	"	125	285/285	6.3vct/2a 6.3v/2.5a 5v/2a	Upright or Flat
U or F125/325	"	125	325/325	" " "	Upright or Flat
U or F125/385	"	125	385/385	6.3vct/2a 6.3v/2.5a 5v/3a	Upright or Flat
U or F150/285	"	150	285/285	" " "	Upright or Flat
U or F150/325	"	150	325/325	" " "	Upright or Flat
U or F150/385	"	150	385/385	" " "	Upright or Flat
U175/425	"	175	425/425	6.3vct/3a 6.3v/2a 5v/3a	Upright
U200/385	"	200	385/385	6.3vct/3a 6.3v/3a 5v/3a	Upright
U250/385	"	250	385/385	6.3vct/4a 6.3v/3a 5v/3a	Upright
PA60/300	"	60	300/300	6.3v @ 2a	Upright
PA80/300	"	80	300/300	6.3vct @ 2a 6.3v @ .6a	Upright
PA180/410	"	180	410/410	6.3vct @ 4a 6.3vct @ 2.5a 5v @ 3a	Upright
PA180/305	"	180	305/305	6.3vct @ 4a 6.3v @ 4a 5v @ 2a	Upright
*T80/280	"	80	280/280	6.3v @ 2.5a 5v @ 2a	Upright

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Check on X-rays

RDS showing the amount of X-ray radiation to which people have been osed in medical and dental X-rays be recommended by the newly ned Government Radiological Adry Council.

hairman of the council, Dr H. G. Wallace, recommends them.

r Wallace is also Director-General of Public Health in N.S.W.

The possible dangers from X-ray ation are at present being discussed over the world," he said.

Doctors are using X-rays carefully present and the usual practice is ably to ask a patient if he or she had an X-ray recently."

he association recently recommended all dentists should provide "aprons" radiation-absorbing material for the ection of patients during X-rays.

Radar for Survey

£3,500 surveying gadget being tested by the Water Board, is accurate to in eight inches in 40 miles.

t is a Tellurometer, developed by the uth African equivalent of the I.R.O. and manufactured by a Capen electronics firm.

t is the latest in surveying equipnt.

he "gadget"—the only one in Austria—comprises a master and a remote each having a circular "radar-type" mounted on a tripod.

t operates in the 10 centimetre wavegth band and measures the travel time radio waves over the distance to be rmined with an accuracy of a fracf of a milli-micro second.

Measurements may be made day or ht and visibility is immaterial.

The operators maintain communicaby radio-telephony.

British Searchlights for Niagara

The best in British searchlight design gone into the production of 20 huge rchlights that are to illuminate agara Falls. B.B.C. reporter Hugh ver, who saw them demonstrated just side London, said in the B.B.C. "adio Newsreel" program: "The projtors are fitted with automatic colourange units, and as many as 15 colours be obtained from the 20 lights, using colour slides in various combinaons.

"The lights themselves are massive affrs. When standing on their mountis they are about nine feet high. The lamps are 42 inches in diameter and the um candlepower of each one is about to hundred and ten million. Special ention has been given to the problem spray from the roaring waters of lagara Falls, and of icing in the colder eather. A prototype was set up and ted and as a result of the experience s gained special protective shields were signed and built into the lights.

"A great deal of care and study has ne into the placing and focusing of e lights, to get the very best effects. our will light the smaller American lls, with another playing a beam on at is known as 'The Bridal Veil.' The ffs of Goat Island, between the Horseoe of the Great Falls and the Ameri-n Falls will have two, and the Horseoe will be lit by eight, four on each le. The remainder will cover the ray bloom, the crest of waves on the pids and a stretch up river."

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RECORD CHANGERS: Collaro 4-speed changer, £18/17/6; Dual, £32/8/6; Monarch. £20/10/; Philips, £25/10/.

RECORD PLAYERS: BSR, £13/15/; Collaro, £12/10/; Thorens latest model with G.E. VRIII head. £35/15/. Many others to choose from.

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SPEAKERS: Goodmans from £15, Magnavox from £6/10/, M.S.P. from £3/10/, Peerless from £6/19/6, Philips from £12/12/, Wharfedales from £6/10/5.

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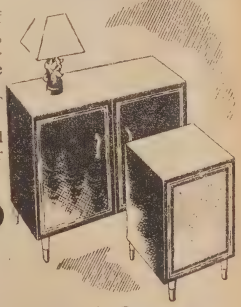

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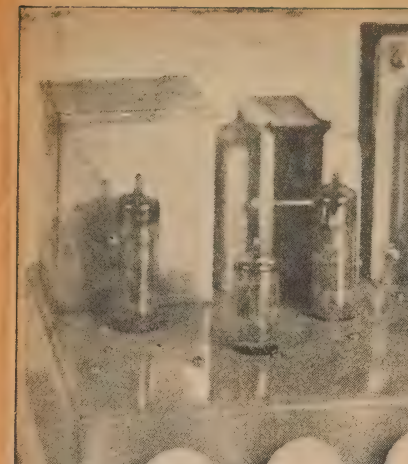


A front view of the stereo amplifier. It comprises dual single-ended channels with a common power supply.

Simple Equipment For Stereo Records

The amplifier described here was built for operation with crystal type stereo pickups. It has excellent frequency and square-wave response, negligible hum, and over 4 watts from each channel. This has proved ample for average home use.

by John Moyle

VERY soon now amplifier enthusiasts are going to be asking a pretty obvious question—what kind of equipment do I need to play stereo discs?

That's going to be a very interesting question to answer.

So far, stereo has been available only to users of tape, and despite the claims often made that there is a vast army of tape users, I'm not inclined to believe it on a population percentage basis.

It's true that plenty of people in America and Europe use tape, and stereo tape, too, but they are only a fraction of those who use discs.

TAPE DIFFICULTIES

Let's be honest—tape is too costly, too difficult to use, and needs too much special equipment to satisfy all but the dedicated. It still needs a costly tape deck, special amplifiers, oscillator circuits and so on; it still uses the old type of reel, which insists on unravelling at awkward moments—for ordinary people, that is—and is altogether too messy to slide smoothly into a domestic routine. In domestic use I believe the whole tape position needs re-examination.

But the disc, once the necessary gear is obtained (and it's less than for any other foreseeable method), playing a stereo disc entails precisely the same motions and lack of intelligence as it always did.

What I mean is, even your six-year-old can be taught to place a disc carefully on a turntable and lower the pick-up to the edge. And if not, an automatic machine can do it for you.

The irritation value of small efforts in everyday life is quite amazing, and the number of good ideas which didn't go over because of trifling complications or a little extra effort must be beyond belief.

If stereo is ever "going over," it will be through the disc, and mainly for the reasons I have given. There seems lit doubt that all the record companies lieve they can make it, and make it w Otherwise they are really playing w fire.

Personally, I think they know exac what they are doing.

For the same general reasons—summ up as being the preservation of simplic —the present standards have be adopted. All the others would have call for extra electronic circuits and filters make them work—more things to wrong and make life harder, even if results had been better.

But all the 45/45 system requires is little more of the same things we ha now—a double-acting pick-up, a du channel amplifier much the same as th we use now, and a couple of speak appropriately located.

You couldn't have it simpler than th

The fact that stereo records are officially out of the experimental sta as yet makes it harder to be dogma about the exact nature of the equipm which will find its own level as standa

But I think it is possible to sugg several lines upon which we can be re sonably certain, and the next few mon will probably see the pattern in operati at least overseas, where the discs w make their first impact.

WIDE APPLICATION

Firstly, I believe the stereo disc w appeal to every class of record user, a it should be possible to produce equ ment to suit every class.

Obviously, we will see the high-fidel enthusiast who will spend a good de of money on the best.

And on this basis it will be costly.

If he now uses a high quality speak system, he won't rest until he gets a other like it. Generally speaking, I thi very good channel balance in sound a compensation is necessary for this ki

of quality—not for stereo of a kind, b for the best stereo. Each channel shou be capable of handling virtually all t program, as it will sometimes be requir to do, with exactly the same type sound.

And, for the very best, each chan should be able to handle almost the sa amount of output as with a monau system, for I have heard records which, for a period at least, nearly the sound was grouped at only one them.

If it takes so many watts to adequat reproduce a trumpet, or a double ba then we must be ready for it, no mat what channel it comes through.

GOOD PICKUP

It's true that much stereo exhibits fair balance between the channels, t the ability to separate as well as to me is definitely a requirement.

And so our meticulous friend will wa a high-class pick-up to start off with, a a double-unit precision-built moving c is going to cost much more relativ than is a double-unit crystal or ceram cartridge.

he now has a big amplifier and con-
unit, he'll want another equivalent
lifier, and a control unit which has
ed controls—all of them.

he sports bass and treble boost, fil-
slope controls and the like, they will
ave to be there twice.

ersonally, I hope it makes our friend,
rge, think further about the need for
e refinements, particularly as he'll be
ing a new kind of sound which will
require the same kind of gadgetry.
that's another story. Just say that
ink a suitable dual control unit can
impler for stereo, although in many
s it won't be.

ll in all, George will be up for
ly twice his original outlay, and he is
nd to ask himself if he can do some-
g better than this.

ESTIMATE

t a guess, I'd say a couple of 10-watt
nnels are going to be very attractive.
y'll sound good anywhere, won't cost
much as a pair of 30-watters, and
't too big to use a common power
ply.

Next on the list is the ordinary home
ogram.

he crystal or ceramic cartridge is
ost a sure thing here, and I note that
if not two makes are already on sale
England. A ceramic has been avail-
e in the U.S.A. for some time. These
structurally very simple, and,
ough the ganged drive presents some
blems affecting resonances and distor-
, I think they'll get over them satis-
orily. They'll use diamond points and
probably end up about twice the pre-
t cost of a good cartridge.

Because their output will be compar-
e with that of present crystals, there
uld be little difficulty in connecting
m to the simplest of twin channel
lio ends.

Valves such as the 6BM8 should be
y useful indeed in such radiograms,
I it's not very hard to arrange for
ged volume and tone controls.

Speakers at each side of a broadish
e of cabinet will sound quite well,
more ambitious perhaps providing the
ra speaker on an outrigger cabinet to
y the separation.

I like the idea of a couple of large
al speakers, which could go up to 12
hes on the long side, mounted verti-
ly in treated cavities to reduce reson-
ces and provide loading. We have had
ne considerable success with this kind
mounting using standard 10 and 12
h speakers and, if not in the top class,
y still sound fine.

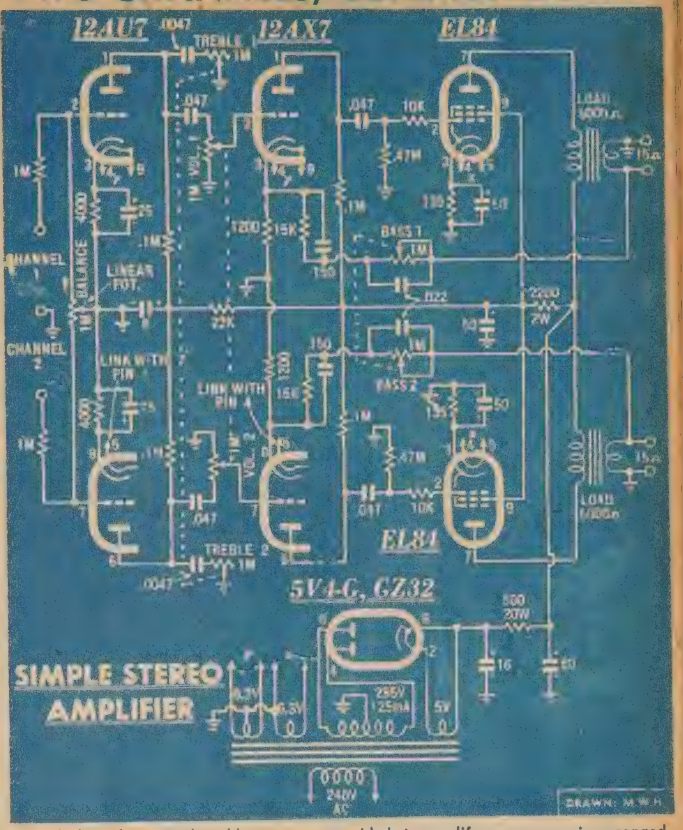
'ILL BE COMPATABLE

I feel sure we'll see many examples
this kind of thing. Because the pick-
s will probably play most L.P.s quite
ll in what is now a duplicate channel
rangement, some kind of compatibility
ll be achieved even if not ideal. Again
is is another subject.

In the tablegram field, I think stereo
ll also prove quite practicable.

It's true one won't get as much of the
atial effect as with larger outfits, but
ost of these tablegrams are used for
pular music, and the separation of the

TWO CHANNELS, COMMON SUPPLY



Both bass boost and treble cut are provided to modify response using ganged potentiometers. The amplifier is just as useful for twin channel monaural work in addition to stereo.

various instruments as used in small combinations will probably be widely exploited in this type.

It shouldn't be hard to achieve this effect even with the comparatively small speaker separation, and a good deal of ingenuity is in order.

The crystal pick-up will again be used here, and because the gain and output will be lower, even further simplification

PARTS LIST

1 chassis to suit.
1 power transformer
285 volts each side of CT at 100 mA, 5 volts, 6.3 volts and 6.3 volts.
2 good quality output transformers 5,000 ohms to 15 ohms

VALVES
2 EL84
1 12AU7
1 12AX7
1 5V4-G or GZ32

CAPACITORS
2 50 uF 350 VW electro.
2 50 uF 12 PV electro.
2 25 uF 12 PV electro.
1 16 uF 525 PV electro.
1 8 uF 525 PV electro.
4 .047 600 V paper.
2 .022 400 V paper.
2 .0047 600 V paper.
2 150 pF mica.

POTENTIOMETERS
3 1.0 meg twin types.
1 1.0 meg linear.

RESISTORS
2 1.0 meg ½ watt.
2 0.47 meg ½ watt.
4 0.1 meg ½ watt.
1 22,000 ohm ½ watt.
2 15,000 ohm ½ watt.
2 10,000 ohm ½ watt.
2 4,000 ohm ½ watt.
1 2,200 ohm 2 watt.
2 1,200 ohm ½ watt.
1 500 ohm 20 watt.
2 135 ohm 3 watt.

SOCKETS
1 octal.
3 9-pin miniature.
2 miniature speaker.

SUNDRIES
Tag strips, hook-up wire, 1 valve shield, power flex, power plug, 3 terminals, 3 knobs, nuts and bolts etc.

Goodmans

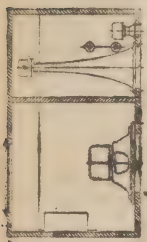
'325' *reproducer*

FULLY IMPORTED COMPLETE MULTI-UNIT hi-fi SPEAKER SYSTEM NOW AVAILABLE

No compromises whatsoever have been adopted in the design of the Goodmans '325.' Each component is the result of exhaustive development aimed at producing an integrated system which provides the utmost accuracy of High Fidelity sound reproduction.

The '325' contains 3 speaker units: 12" direct radiator type bass unit which operates from 30 c/s to 750 c/s; pressure type mid-range unit operating from 750 c/s to 5K c/s; pressure type treble unit operating from 5K c/s to 16K c/s. The mid-range and treble units are provided with variable constant impedance attenuators, externally operated. Network XO 750/5000.

When using the Audium 60 as the bass unit, the reproducer is known as the '315'; when using the Audium 70, the '320'; and when using the Audium 80, the '325.'



The enclosure is internally divided into two parts: the upper portion containing the treble and mid-range units and their attenuators; the lower portion containing the bass unit loaded by an Acoustical Resistance Unit in the rear wall of the chamber.

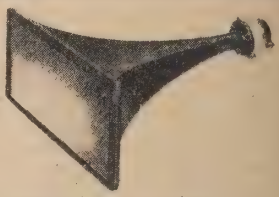
AUDIUM BASS LOUDSPEAKERS

AUDIUM 80

	AUDIUM 60	AUDIUM 70	AUDIUM 80
Flux Density	14,000 GAUSS	17,500 GAUSS	14,500 GAUSS
Bass Resonance	35 c.p.s.	35 c.p.s.	35 c.p.s.
Power Handling Capacity	15 watts	20 watts	25 watts
Impedance at 400 c.p.s.	15 ohms	15 ohms	15 ohms

TREBAX HIGH FREQUENCY PRESSURE UNIT

Frequency Range	2,500 c.p.s. to 16,000 c.p.s.
Impedance	15 ohms at 10 Kc/s
System Power Handling Capacity	25 watts
Crossover Frequency	5 Kc/s



MIDAX MID-RANGE PRESSURE-DRIVEN HORN UNIT

Frequency Range	400 c.p.s. to 8 Kc/s
Impedance	15 ohms at 400 c.p.s.
System Power Handling Capacity	25 watts
Crossover Frequency	750 c.p.s. and 5,000 c.p.s.

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Name .....

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..... RH/5/58

possible. Maybe even new valves ll make their appearance to give ough gain for a complete channel in e envelope, even if it's not easy at the oment.

What seems to be a very good proach, somewhere in between the aborate and the simple, would be the e illustrated by the amplifier detailed this article.

As I mentioned in our last issue, I was rtunate enough to obtain one of the st pre-production crystal pick-ups from ngland, and I have been playing it etty constantly with some American scs and some odd test records which rtain people have been good enough lend me.

Assuming the production pick-ups are en better than the one I used, this nplifier, despite its modest cost and simicity, has done remarkably well, and is ample quantities of everything needed r average home listening.

I built it purely as a first effort see what might be needed for this pe of pick-up, but it turned out so well at it might yet be hard to better in s class.

CKUP OUTPUT

The output capabilities of a stereo ick-up were largely unknown at the time ecause the degree of modulation of a pical stereo disc was also rather vague. ly records were the first efforts of the ompanies who made them, and are not ecessarily an accurate guide as to what e can expect. My impression now is iat they have plenty of amplitude.

I noted that both elements gave .16 olts in parallel from a monaural freuency record, with 8 grams of pressure, nd feeding a 2 meg load. The response urve looked good from way down to bout 10 Kc, with the usual rise about -7 Kc.

In other words it looked a pretty verage kind of crystal of moderate outut and better-than-average quality, so I eckoned I'd treat it as such. I aimed or an amplifier which would give full utput with about .1 volt in. As the st curve was pretty flat from the record, reckoned on no bass cut but some ass boost, and no treble boost but some reble cut.

Single-ended output was inescapable, as he total drain would be something over 00 mills, much the same as a 10-watt ush-pull job. I wanted to use a common ower supply.

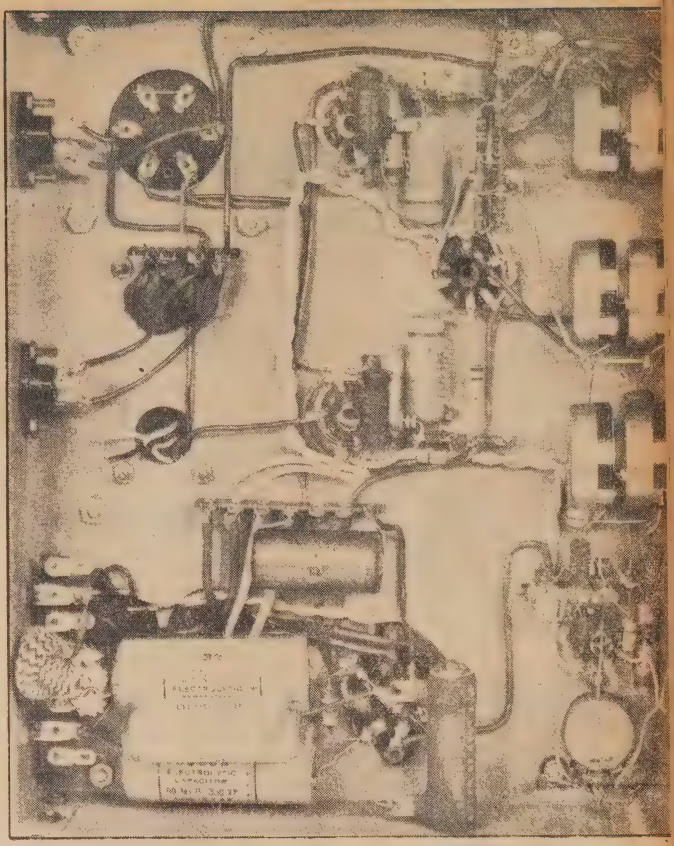
One obvious way would have been o use a pentode ahead of an EL84, he standard output valve in its class, nd put all the compensation ahead of he first valve.

A point against this approach is the act that, after the gain control, full mplification is provided all the time, and have had trouble with valve hiss doing this way, particularly with the more nodest speakers which tend to peak in he middle response.

'WIN TRIODES

An alternative was to use a pair of win triodes, one as a pre-amplifier and he other to drive the output valves in a eedback circuit. As the sensitivity of the ast pair would be no more than 1 volt, reckoned this would work out better, nd leave me still with ample gain. Both nethods would use a total of four alves, two to each channel.

UNDER CHASSIS OF STEREO AMP



Under chassis picture shows that the layout has been purposely kept symmetrical. As there is nothing critical about it, even compact layout could probably be used.

At any rate I chose the latter, although I'm not implying that the first wouldn't have worked quite well.

Each channel I decided would use a 12AU7 section as preamplifier, a 12AX7 to follow, and an EL84 in the output stage.

OVERLOAD DANGER

It seemed certain that one high-gain triode would be needed, and the obvious position was in the second socket.

This was because the pick-up could conceivably overload a 12AX7 grid circuit on peaks, and if a divider or a gain control were wired here, high frequency loss through Miller effect would be serious. With the lower gain 12AU7 it would not matter. Remember the pick-up requires a load of up to 2 megs.

In the second socket, and preceded with a gain control, there would of course still be Miller effect operating, but as I intended to use about 20 db of feedback to include the 12AX7, I expected this to reduce it to a negligible amount.

Also the volume control could be lower in value. I used 1 meg, but even .5 meg would probably have been O.K. with one-quarter the resistance to b considered in the presence of Mr Mille

The feedback presented no real pro blem. Its hard to beat the cathode injec tion method from the voice coil, an plenty of feedback is a good thing wit a single-ended stage where distortion much higher than with push-pull.

I stuck to the 20 db figure, althoug more could have been used without insta bility.

I went warily about using commo cathode bias resistors as I didn't war to run into coupling between channel either on music or to cause instability I got neither, and it would probably b in order to think again about this poin

AMPLE GAIN

Without going through the process c checking valve curves and operating co ditions, it is enough to say that th amplifier channels worked out as expec ted, except that the gain was higher. Sen sitivity was about 50 millivolts for fu output, and the gain control was un necessarily crowded.

Up to this stage I had used feedbac

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William Willis & Co. Pty. Ltd., 428 Bourke Street.

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Modular Electronics, 579 Sydney Rd., Seaforth.
Magnetic Sound Industries, 387 George St.

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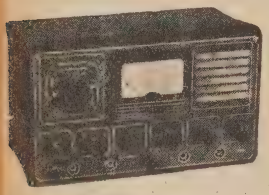

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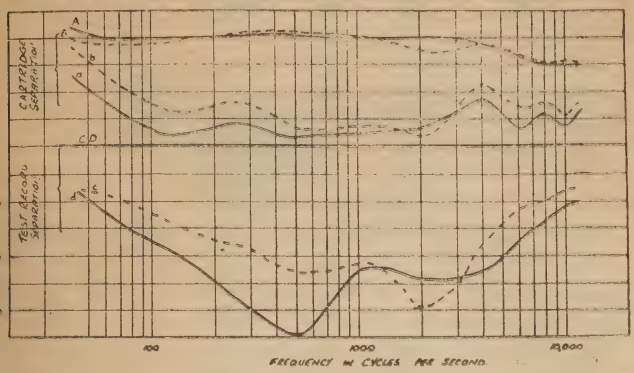


Curves for the Acos pre-production pickup showing channel separation. Test records referred to are not available here.

resistors in series with the bias resistors of 12AX7, so I removed them and applied feedback directly to the unbypassed cathodes. This dropped the sensitivity appreciably, but it was still higher than required. It also improved square wave response.

Rather than seriously upset a very neat arrangement, I ran a divider across the 12AU7 input to reduce the applied pickup voltage by about two-thirds, and this worked out just about right. There was the added advantage of lower input volts to the 12AU7 and lower distortion, but there is little danger of overloading this grid in any case.

Because of the high feedback, there isn't much danger of overloading the 12AX7 either, for its effective grid drive is a very small fraction of a volt.

Having tailored the amplifier chain, the next thing was to arrange for treble cut and bass boost.

The cut could only be applied to the 12AU7, for it is the only valve outside the feedback network. A simple tone control circuit did the trick here, providing about 15 db of cut at 10 Kc with very little at 1 Kc in the full "on" position.

The bass boost called for a little more thought, and eventually it was wired into the feedback circuit.

Any other method would have required a considerable loss in gain somewhere along the line, too much to be made up by any reasonable operating condition for the triodes.

NO INSTABILITY

There is virtually no danger of instability because with feedback over only two stages the circuit is inherently stable. So I included a capacitor in series with the feedback circuit as we have often done in the past with simple jobs, and wired a variable resistor across it to bring it gradually into circuit as the boost came on.

The 20 db of feedback allowed about 15 db of boost at 75 cycles, after which it fell away so that at very low frequencies it is actually a good deal less.

This is primarily due to the falling response of the single-ended transformer in this region, a difficult thing to avoid where there is no balanced plate current to help hold up the inductance.

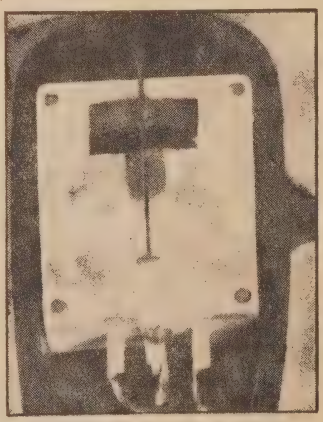
But fortunately in a modest outfit like this, speakers which are good below 50 cycles are the exception, and I didn't count this a bad point.

And the boost is only there in case it is wanted, for the pick-up's characteristics show that it holds up fairly well with the load specified.

Naturally all the controls had to be ganged for dual operation, and I obtained these by ordering them. Normally radio shops don't keep them in stock but, particularly if we can standardise on a few values, they will do so as the demand grows—as it will.

In this circuit, I made them all 1 megs, and they worked out quite well. They can all be logarithmic, with the tone controls connected to give the most gradual change.

Although the gain of each channel worked out very much the same, and in any case could have been adjusted by the feedback circuit, it is really essential



Photograph of Acos cartridge. Stylus is anchored at the bottom and connected to a nylon bridge which transmits motion to twin units. Production models will probably use redesigned stylus assembly.

TAPE TO DISC

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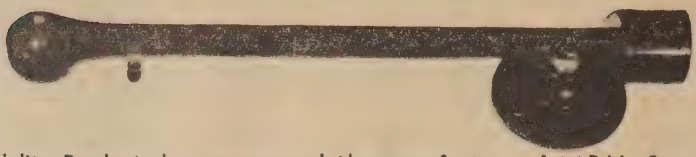

High Fidelity Products has commenced the manufacture of M.B.H. Stereo plug-in heads to be used with all "C" and "D" type M.B.H. arms.

No doubt for some time the number of stereo discs will be limited. In the meantime enjoy the finest sound from single channel recordings with the new "D" type M.B.H. heads. These fit all M.B.H. arms of the plug-in type.

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10th February, 1958.

MR. BELL,
R.C.S. Radio Pty Ltd.,
651 Forest Rd.,
BEXLEY, N.S.W.

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With threevolts bias on the A.G.C. line the IF strip showed a mid-band sensitivity of 2mV at the first IF grid for 1 volt DC at the vision diode. With no bias on the A.G.C. line the sensitivity was approximately 40uV and the amplifier quite stable.

Built according to the sample described the strip could be used to build a receiver of the highest standard of performance to compare favourably with any commercial receiver on the market.

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27 2 amp Line Filter with condensers	65/-

Above prices are Retail Prices and inclusive of Sales Tax.

The two photographs which appear above were taken by Cecil Watts from one of the first experimental Decca 7-inch 45 r.p.m. stereo discs, and they show with remarkable clarity the enormous strides which that company has made in stereo disc recording. Such photographs, apart from their great historical interest, are invaluable aids towards a better understanding of disc stereo as a whole, for they show precisely what the cutting stylus does in response to the double inputs from the recording microphones. The eight sections of the groove were all photographed from the first six or seven turns of the spiral on the outer edge of the disc.

GROOVE 1 shows modulation on the right channel only, with the left-hand wall of the groove virtually straight.

GROOVE 2 shows modulation on both channels, while GROOVES 3 and 4 indicate little or no right-hand channel modulation, with a fairly heavy signal recorded on the left wall of the groove.

GROOVE 5 (right-hand photo) shows the maximum lateral movement of the cutting stylus, as it has travelled in its simultaneous downward and outward journeys.

GROOVE 6 provides clear evidence that the sample disc has been played, for groove material has been pushed up on the right-hand wall. GROOVE 7 shows (compared with 5) the maximum rise of the wave form, in the upward and downward movement of the cutting stylus. GROOVE 8 shows an absence of any modulation.

—Hi-Fi News

have some means of balancing the two channels at the input.

The output of crystal units isn't so accurately controllable as to be exactly the same, and although in practice some balance mightn't be serious, it was thought wise, and quite easy, to include a balance control.

As already mentioned, the input from the pick-up is divided down, and we made use of this arrangement to provide a common potentiometer as the lower end of each circuit.

If you look at the schematic, you will see that the earth point for the input circuits is the moving arm of the potentiometer.

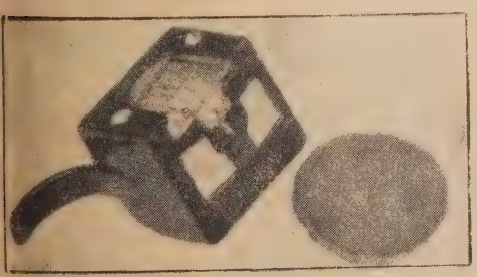
When hard over in one direction it will reduce the input from that section of the pickup to zero and vice versa. Thus the balance is completely controllable from maximum on the one hand to nothing at all on the other.

It is best to specify a linear potentiometer here, although a logarithmic type could be used. The linear pot. relates the amount of rotation more directly to the balance voltage and it feels better that way.

Actually, as you will see, the load on the pick-up is only 1.5 megs on each side, but because of the bass boost control this isn't significant and avoids awkward values.

In any case, production pick-ups might have different load requirements, and the values here can be switched around to suit.

Once the channels are balanced —I found I could do this usefully on surface noise or with a lateral fre-



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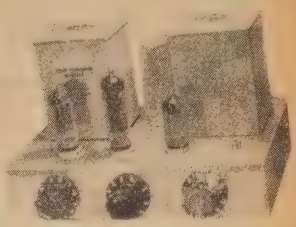

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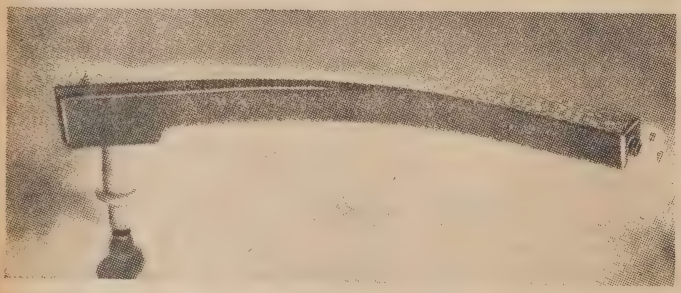

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uency disc—this control need not be djusted further.

The common power supply gave no ouble. Any transformer capable of roviding the right voltage and current an be used. Ours was a 125 mill type case we wanted a tuner at a later date.

The filtering provided a few thought- ul moments, but I ended up by doing the easy way.

I simply used a resistor in place of a lter choke, and high value electro- tics to get good smoothing.

The resistor is of any value which pro- ides about 260 volts between the output lates and ground—in my case 500 ohms as near enough. A few volts over won't latter because the screens are fed rough the second section of the filter, nd therefore are a few volts below the lates.

OW HUM

The extra filtering helps to reduce hum, bit more bothersome than with push- ull because there is no cancellation in e output stage.

When I finished, it was just possible hear some residual hum close to the eaker when all was quiet, but it was w enough for me.

It might be good enough for you by mitting the capacitor from the rectifier thode and reducing the resistor value about 350 ohms to compensate for e voltage drop. But an extra electro- tic isn't much, and I put it in.

The rating of the first capacitor must e higher than the others, at least 450 olts peak. The remainder can be of 275 r 300 volt working type, but see that our voltages do not exceed this figure.

Electrolytics make a bit of a mess hen they blow up in your face!

The layout was kept symetrical mainly that we could see our way about, and ou can get awfully mixed up between hannels if the wiring isn't easily trace- ble. The input terminals and balance ontrol are at one edge at the front, nd the coupling capacitors run under e treble control to the volume control hich is the centre of the three. Here connects with short leads to the 12AX7 nd equally short leads are used for the eble control. The bass control has a anel directly behind it carrying the cath- de resistors and feedback components e voice coil leads running along the ide of the chassis to the output trans- ormers.

The remaining components are ounted with tag strips, again with short eads.

There was no need to shield any of he input circuit, which is relatively in- ensitive to hum pick-up because there are no high sensitivity points.

The unused terminals of the rectifier socket were used to support the two de- coupling resistors, and the electrolytics are grouped nearby. The shield on the 12AU7 is not strictly necessary.

Both transformers have 15 ohm out- puts because we used this type of speaker.

There are several very good output transformers available, and to illustrate the point we have used two of different makes. As their characteristics are not always the same, it's good to have a similar pair, to ensure the same kind of frequency response and efficiency.

The performance of the amplifiers is extremely good. In the flat position they are virtually flat from below 30 cycles to 40 Kc with about 1 db drop at 50 or 60 Kc and a steady drop thereafter. Square wave performance, too, was almost as good as with the larger ampli- fiers, even at 10 Kc. The power curve over the audible range is almost constant. We have not measured distortion figures, but these should be just about optimum for circuits of this type. The output from each section was something over 4 watts at the secondary.

As mentioned earlier the purpose of this amplifier was to demonstrate the kind of thing which could be built, and it does not represent the only way. For instance it looks as though a pair of 6BM8s could be used as the amplifier proper, although this would probably call for a restatement of overall gain and even circuitry. One advantage of our circuit is that it could be built up with a wide variety of valves, 6SN7s and 6SL7s would probably be quite in order in place of the miniatures, and almost any output pentode would be O.K. It is therefore very flexible, and there is enough reserve in several respects to ensure good results with appropriate circuit values.

TWIN CHANNEL

Even if not used initially for stereo, it could be used as a twin channel job fed from a single crystal pickup, with no changes to be made when stereo car- tridges become available. It sounds very well this way. In fact we spent profit- able sessions trying out stereo discs played with the two pick-up units in parallel, just to see how much better they sounded when changed over to stereo.

You could even use one channel with treble cut, and the other with bass cut (by using low value coupling capacitors) to give you an electronic cross-over effect for multiple speaker experiments.

You can do quite a bit with two channels.

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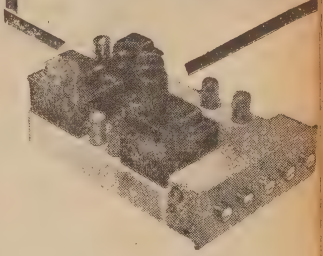
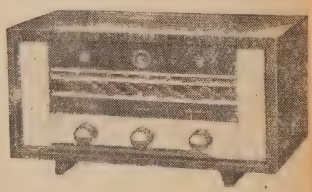


Preamplifier may be attached to main amplifier or installed 25 feet away with the Pye remote control cable. Flat response from 20-100,000 cycles. Less than .1% distortion at rated power.



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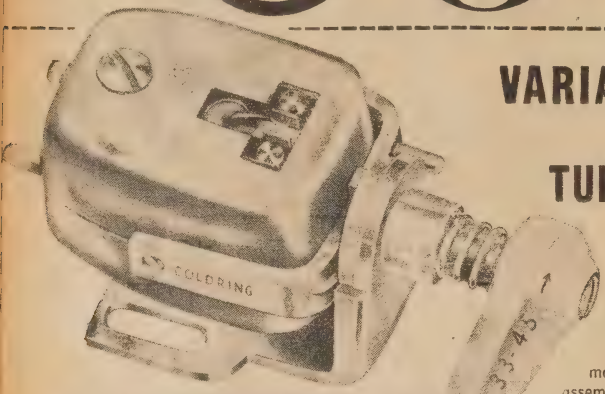

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Read these extracts from Technical Reports by P. Wilson, M.A., in "The Gramophone" for October 1957.

"Tested when used with a Quad 11 Amplifier and a Decca Microgroove Constant Frequency Record (LXT 5346) results were as follows:—

From 18 kc/s down to 1 kc/s: dead flat.
From 1 kc/s to 100 c/s: rising to +1½ db.
From 100 kc/s to 50 c/s: falling to −2 db.
From 50 c/s to 30 c/s: falling to −6 db."

"... Long range, exceptional smoothness and low distortion."

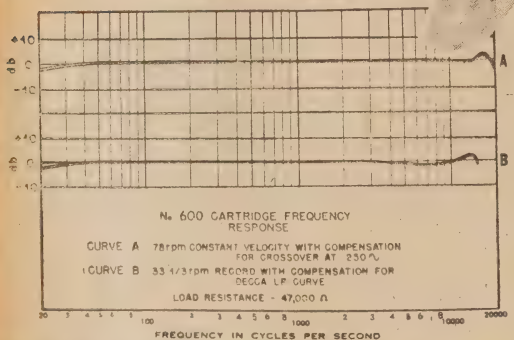
"... Near perfection."

"... This cartridge is an instrument of virtually laboratory precision and sensitiveness."

"... an instrument which will be a joy and a delight for many a long day."

"Carefully used, the life of the Diamond, *provided that meticulous care* is taken *to keep records free from dust*, may be as much as 3,000 hours' playing time."

"... will rapidly find its place throughout the world as maintaining and enhancing the reputation which the "500" cartridge so worthily achieved."


No. 600 CARTRIDGE FREQUENCY RESPONSE
CURVE A 78 rpm CONSTANT VELOCITY WITH COMPENSATION FOR CROSSOVER AT 250 ∿
CURVE B 33 1/3 rpm RECORD WITH COMPENSATION FOR DECCA LP CURVE
LOAD RESISTANCE - 47,000 Ω
db
+10
0
-10
FREQUENCY IN CYCLES PER SECOND

TECHNICAL SPECIFICATION

Type: Magnetic variable-reluctance turn-over cartridge.
Styli: (1) .0025 in. rad. sapphire for 78 r.p.m. (green).
(2) .001 in. rad. diamond for microgroove (red).
Normal tracking pressure: 7 grams.
Lateral compliance: Not less than 5 x 10^{-6} cm/dyne.
Stylus restoring force: 2 grm. (for 100 microns displacement).
Effective mass at stylus tip: 2 milligrams.
Output (average): 3.2 mV per cm/sec.
D.C. resistance: 1,500 ohms.
Impedance: 54,000 ohms at 1 kc.
Recommended load resistance: 68,000 ohms.
Frequency response: Linear from 20 to 21,000 cps within ±2db.

GOLDRING "600"
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Also available with two sapphires only .. £12

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All About Audio and Hi-Fi

peaker Mounting

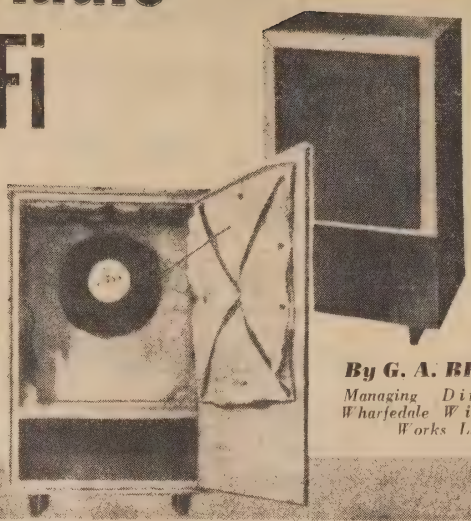

Fig. 1. Outside and inside views of the cabinet described in the article. The entire top section is lined with 1-inch padding.

By G. A. BRIGGS
Managing Director, Wharfedale Wireless Works Ltd.

art 9—The concluding article of our series on loudspeakers. t deals with the construction of cabinets and baffles, their characteristics and their uses.

E now come to the last—and most difficult to write—instalment in this es of articles. In fact, if we had not ady committed ourselves to deal with nets, baffles, etc., I think we should s put up the shutters at the end of 8. The subject is so vast, and so h has already been written about it, it is difficult to know where to start; always much easier to write at length ut a small problem than to deal fly with a big one.

t any cost, we must avoid a rehash what has gone before, but I think we ht usefully begin by outlining our st thoughts on the old, old questions h are so very important.

) The first thing to remember is that nets and horns are a necessary evil, l to avoid cancellation of sound waves n back and front of a cone. They 't improve the quality of sound and should be much better off if we could without them.

2) Although it is possible to improve performance of small enclosures by oustic devices, it is almost impossible make a small cabinet sound like a one.

3) With reflex enclosures, dodges like ing pipes and diaphrams to vents make difference to resonances, which are ed around but not usually eliminated.

4) Padding enclosures and hanging es in them gets rid of standing wave cts and often smooths the response, the speaker unit is still working in abinet which colours results.

5) Folded horns are a useful device r obtaining large-scale results in a ited space, but a folded horn is not y exponential and never equals a ight one.

(6) Flat baffles are better than is generally believed.

They are free from cabinet resonance. Two speakers in parallel on one baffle

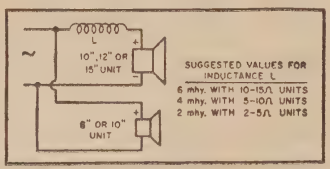
L
10", 12" OR 15" UNIT
SUGGESTED VALUES FOR INDUCTANCE L
6 mhy. WITH 10-15Ω UNITS
4 mhy. WITH 5-10Ω UNITS
2 mhy. WITH 2-5Ω UNITS
6" OR 10" UNIT

Fig. 4. Shown here is a useful circuit that may be employed to obtain good results with two loudspeakers mounted on an open baffle. The two speakers are connected together in phase to avoid "hole" in the response.

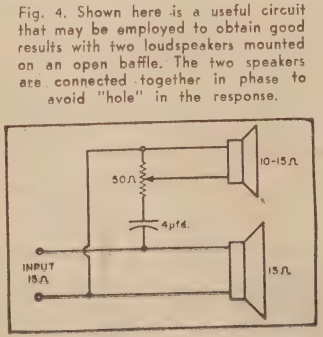

Fig. 2. Adding a 10-15 ohm tweeter to augment response above 3-5 kc. If the impedance of the main loudspeaker is 2-3 ohms, the tweeter should also be 2-3 ohms. The filter capacitor and volume control should then be 12 ufd. and 20 ohms respectively. For 8-ohm units, the capacitor that is employed should be about 6ufd.

give a 3 db gain at low frequencies and double the power handling capacity so that bass lift can be used in the amplifier, resulting in four times the low-frequency output of a single unit.

The floor also improve bass by reflection, and walls can be harnessed in the same good cause. Baffles are efficient because the sound from both sides of cone is used, and I am now inclined to the belief that equal air loading front and back is a good thing.

(7) Directional effects are serious. It is only necessary to look at an orchestra to realise how omni-directional most instruments are; hence the virtue of omni-directional reproducers, especially in upper registers.

(8) Convenience in use is becoming more and more a necessity as the interest in hi-fi reaches the music lover as distinct from the sound enthusiast. Some compromise is always necessary and perfection is as far off as ever, so the foregoing drastic observations should not be taken too seriously. Sighing for the moon does not bring it any nearer.

CABINET CONSTRUCTION

Details are now given for the construction of reflex cabinets of two sizes. The fact that we deal with vented enclosures and not with corner horns does not mean that we have any prejudice against the latter; it simply means that we have done more work on reflex designs and therefore have more first-hand information available. Many people prefer horn loading; I could be happy with either if soundly conceived and constructed.

The cabinets described are fitted with an acoustic filter designed by my colleague, Mr R. E. Cooke, and calculated to give bass without boom. The device is the subject of patent applications and should therefore only be used privately in cabinets constructed at home. Although designed around **Wharfedale** 10in

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At 3¾" per second . .

music is recorded with quality and presence never before achieved at this speed. (Response is 40—8,000 c.p.s. plus minus (2 db.)

At 7½" per second . .

the "Tandberg" gives the truest High Fidelity full range sound (30-16,00 c.p.s. plus minus 2db.). so far onl obtained with big studio machines at speed of 15" per second.

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Single lever control start, stop, fast forward, rewind and play-back. A 3 position switch changes speed as required, and AUTOMATICALLY SELECTS THE CORRECT EQUALISATION. A mechanical interlock prevents accidental erasure. A unique time indicator accurately locates any part of a recording. Hi-Fi output and radio or phono input jacks are fitted at the rear of the cabinet.

Brief Specifications

Inputs: Hi-impedance microphone, 1 meg. Phono or radio, 500K (Both inputs can used simultaneously for mixing).

Outputs: 2.5 watts, 4 watts peak, low-level output to hi-fi system, monitor output headphones.

Wow and Flutter: Below 0.1% at 7½ in/sec.

Heads: .00028 head gap. Dual track record-playback. Separate erase head

Signal to Noise Ratio: 60db below highest recording level.

Recording-level Indicator: Electronic-eye tube.

Time Indicator: Built-in dial.

Direction of Travel: to international standard, and for pre-recorded tapes.

Equalisation: to CCIR specification.

Measurements: 15 in. length. 11⅞ in. width, 6⅝ in. height.

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d 12in foam surround units, the inets can be used with other speakers vided the open baffle resonance does t exceed 45 cps.

The vent is tuned to resonate at about cycles—low enough to avoid colora- n and high enough to give body to reproduction. The vent output will w out a lighted match at the resonant quency with 2 to 3 watts input to the aker.

The acoustic filter is made of plywood d should form an airtight fit to the nt, sides, and back so that the only path from the upper compartment to lower one is through the slits which mit the required transmission of low quencies only. This also explains why lower compartment is not lined with sorbent material.

The design and dimensions for the in model are given in Fig. 5 and are f-explanatory.

The data for the 10in model is as fol- vs:—

Cabinet in ¾in plywood
Volume—2 cubic feet
Height—28in outside
Width—14in outside
Depth—12in outside
Vent—2in diameter circle

Acoustic filter in ¾in plywood with four slits 1/16in wide and 8¼in long over-all. Position 17in from top, outside. Vent resonance 45 cps.

Suitable slits in the acoustic filter are ily made with a hand saw, or better ll, with a circular saw.

Photographs of a finished cabinet with ide and outside views are reproduced Fig. 1.

Taking into account size, cost, and ease construction, the reflex enclosure still ys better dividends in the bass than any ner system.

The smaller unit can with advantage used in the larger cabinet, but the ocess should not be reversed.

DDING A TWEETER

If it is desired to improve the high- quency response, the simplest method to mount a tweeter on a small baffle—eferably facing upwards—and stand it top of the main cabinet, using the cuit of Fig. 2.

AFFLES

Having paid baffles a few compliments, e least we can do is to give the reader few hints on how to get the best out of ch a system.

Two speakers in parallel are the vious choice for 3 db gain at low fre- encies. Sheet aluminium ¼in thick, ck with fibre board or coated with a mping medium, makes a splendid baffle d gives a nice crisp tone to the repro- ction. If plywood is used it should sandfilled as shown in Fig. 3. The mensions combine reasonable perform- ce with convenient size.

For the bass end, a 10in, 12in, or 15in eaker could be used, but the resonance ould be not higher than 40 cycles. It ust be made clear that it is the availa- ity of low resonance units which makes ssible this new approach to the long- scarded open baffle.

In order to reduce middle and treble t maintain maximum bass, an in- ctance can be placed in series with this it, as shown in Fig. 4. The tapped it (used alone) described in Part 8 ould make an ideal variable control re.

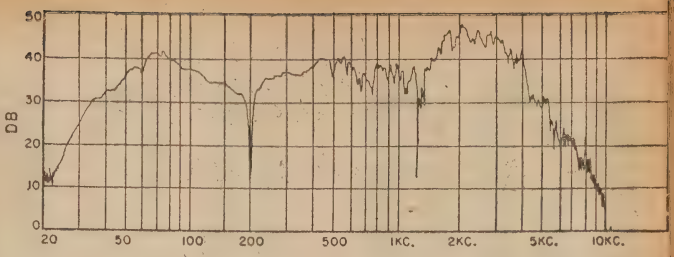

Fig. 6. Response curve of 15-inch loudspeaker unit in 9 cu. ft. corner reflex enclosure which has been constructed with sand-filled panels. The input level was 2 watts and the microphone distance was 4 ft. on axis, and 3 ft. above ground.

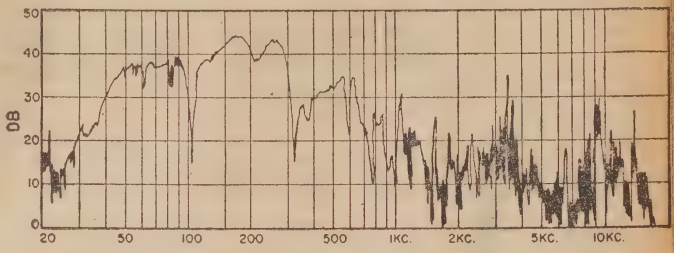

Fig. 7. Response of 15-inch speaker in folded corner horn having volume of about 13 cu. ft. Input was 2 watts. Mike distance 4 ft. on axis, 1' 8" above ground.

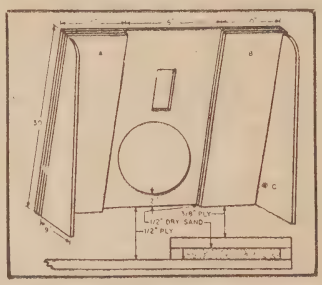

Fig. 3. Shown in this illustration is a back view of the simple flat baffle arrangement that is discussed in the accompanying text. The front sheet of plywood should be at least one-half inch thick. The two portions marked A and B are backed with three-eighths plywood which is spaced one-half inch for sand filling. This is shown in the detailed view. The side supports, marked C, may be constructed of one-half inch plywood. The dimensions shown are not critical.

The second speaker could be an 8in or 10in unit, with resonance preferably below 50 cycles, but even above 50 cps is acceptable because parallel working makes the higher resonance virtually harmless. Here we have shown a slot in place of the usual circular opening to reduce beaming and improve high-frequency dispersal. Useful dimensions are: 8in unit, slot 3in x 7in; and 10in unit, slot 3in x 8in. The two speakers **must** be correctly phased. If they are out-of-phase you will have a 20 db loss at low frequency instead of a 3 db gain. Adding a tweeter with the circuit of Fig. 2 is simple and phasing at high frequencies is of no consequence in this case.

Even a single speaker can be used on a baffle with good results, but low cone resonance is essential. So much for baffles. At least they are free from boom.

REFLEX V. HORN LOADING

It is not our intention to hold a beauty contest to pick the winner here, nor do we propose to outline vital statistics; it is better to leave the choice to personal preference. But I do think that the response curves of Figs. 6 and 7 throw

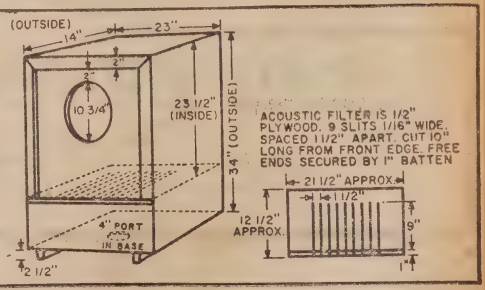

Fig. 5. Reflex cabinet with Wharfedale acoustic filter that is suitable for 12-inch loudspeakers with cone resonances not higher than 45 cps. The vent resonance in this unit is 40 cps

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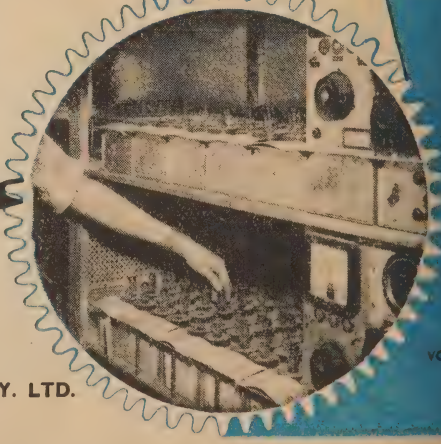
6BE6	22	0	0	0
6BV7	10	0	0	0
6AQ5	12	0	0	0
6BA6	12	0	0	0
6AV6	12	0	0	0
6AU6	10	0	0	0

Total hours attained	-- 100,000
Maximum hours attainable	-- 100,000
% Maximum hours attainable	-- 100%

W. J. Everett.
W. J. Everett.
Valve Rating Laboratory.
28/4/58.

In keeping with their policy of maintaining the highest possible standards of reliability, the Amalgamated Wireless Valve Company employs many rigid life tests. One such test is the 'A.W.V. Receiver Life Test'. In this test, samples of Radiotron Valves taken at random from production are first tested in brand line receivers and operated for various lengths of time under cycled "on-off" conditions identical to those encountered in the field.

The life test results shown here demonstrates as a result of this policy, the outstanding reliability that to-day, synonymous with the brand Radiotron



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me light on the question of relative iciency which was raised in the previous ticle.

Both curves were taken out of doors ith the same 15in foam-surrounded nit, and with the cabinets placed in a rner formed by the walls of a building. he microphone distance was four feet n-axis in both tests.

The conclusions to be drawn from ese tests are as follows:—

(1) The output below 100 cps is about ie same in both cases.

(2) The main output from the horn is cated between 100 and 400 cycles but, hen comparing it with the reflex model, should be remembered that this has onsiderable vent output with a peak ound 200 cps as shown in Part 5.

(3) As usual, the working range of ie horn is limited to 3 to 4 octaves, ut the reflex design will easily xtend to 7 octaves. Above 500 cycles, effections play havoc with the out-ut of the folded horn, but such ffects are normally sidetracked by cross-ver networks.

VHICH?

So we are left with the 64,000-dollar uestion of how best to assess the effi-iency of either system. If you take the orn performance between 100 and 300 ps, I will take the reflex output between 00 and 1,000 cps and confound you, or will take the next two octaves and nock you clean out of the ring. On ie other hand, we can all take the egion of 40 to 100 cycles and practically all it a draw.

The fact is that it is quite as logical o say that reflex loading is twice as effi-ient as horn loading because it covers wice as many octaves as to say that horn oading is much more efficient than other orms because it squirts out more con-entrated sound. It is rather like taking shower bath; the available jet of water ust be nicely spread out for comfort.

It should be explained that these tests vere made with a front-loading horn, the utput from the back of the cone being urposely absorbed. Results would have een quite different with a back-loading orn, where the output from the front f the cone plays straight into the room The axial response curve above 1,000 ycles, for what it is worth, would then e similar to Fig. 6 but it would **not** e horn loading.

For ordinary listening, I would say hat, by and large, horn loading gives nore output than reflex cabinets, offset o some extent by directional effects when ests are extended to higher frequencies nd shorter horns, where open baffles vould be used in preference to reflex nclosures. The overall difference is nothing like the oft-quoted 40 per cent fficiency for horns with less than 10 per cent for other systems.

Using the models of Figs. 6 and 7 as he bass end of a three-speaker system, liked the reproduction from either and ound it difficult to express a definite preference.

CONCLUSION

We now reach a conclusion with which ve can all agree, for I mean only that ve have come to the end of the series. Mr Cooke joins me in saying that it has been a great pleasure writing for "Radio, TV and Hobbies" and we hope to have succeeded in expressing our views with-out treading on too many toes.

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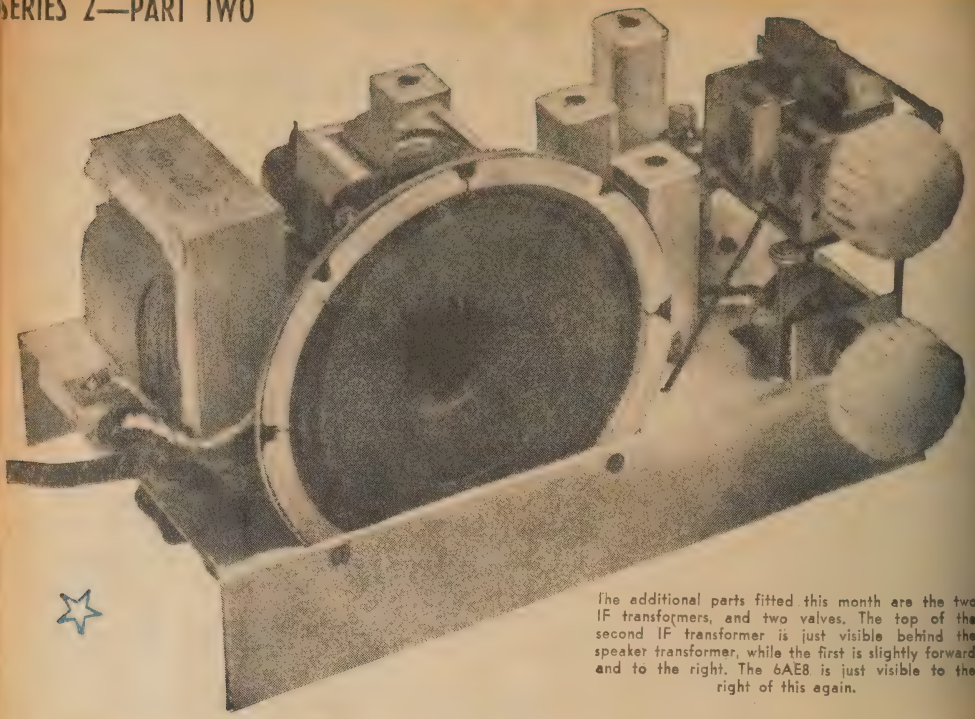
SERIES 2—PART TWO



The additional parts fitted this month are the two IF transformers, and two valves. The top of the second IF transformer is just visible behind the speaker transformer, while the first is slightly forward and to the right. The 6AE8 is just visible to the right of this again.

Learn While You Build A Receiver

Here is the second section of our beginners' receiver which we commenced last month and which describes the wiring of the detector, AVC system, and IF amplifier. By the time we complete this section we will be well past the half-way mark and within sight of the complete set.

by Philip Watson

As in the case of last month's section, it will help considerably if we consider the basic principles involved in this section, before we commence the actual construction.

First the detector. This is a truly fundamental device because every set, from the humble crystal set right up to the multi-valve all-wave monster, must have it in some form. In fact, in the case of the crystal set, it is the crystal itself which performs this function.

The signals sent out from the transmitter, if fed to headphones or loudspeaker, are not capable of producing any audible sound, regardless of how much we amplify them. It is the detector's job to convert these signals into an audible form; into the "audio signals" we mentioned last month.

The simplest concept of a detector is that it is a rectifier—a device which restricts, or completely blocks, the flow of current in one direction, while allowing it to flow freely in the opposite direction. Even if you cannot follow any more than this right now, this is a fundamental point well worth remembering.

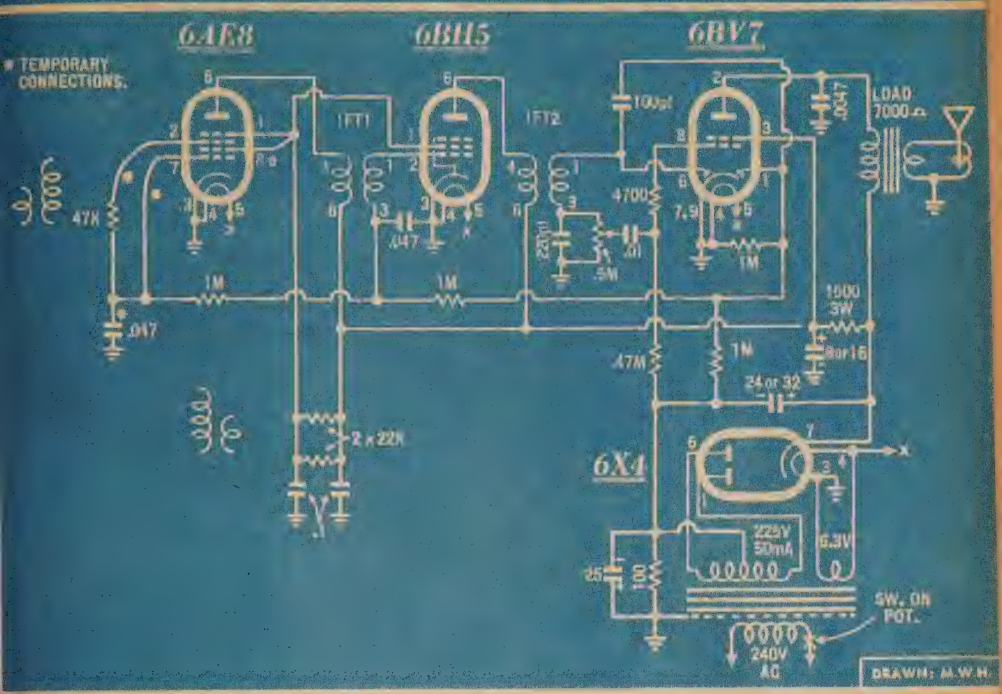
But let us see if we can get a better grasp of it than this. First we need to have a clear picture of the type of signal sent out by the transmitter. As a first step, a transmitter sends out what is called a "carrier," a signal produced by generating a high frequency alternating current of constant strength or "amplitude."

The frequency determines the place on the tuning dial where the station will be found and, for the broadcast band, will be somewhere between 540 and 1,600 Kc (kilocycles or thousands of cycles per second). Whatever this particular frequency may be, it will be held absolutely constant.

The carrier by itself is of little value, since it does not convey any information. It will only do this if we "modulate" it in some way, i.e., vary one of its characteristics in accordance with the sounds we wish to transmit. The amplitude is the most convenient one to vary and this is what is done on all broadcast band signals. It is easy to see the origin of the term AM (Amplitude Modulation).

Let us examine this more closely. As

SECOND SECTION—DETECTOR, AVC & IF STAGE



The additional components are wired as shown in this circuit. Compare it with last month's circuit and the nature of the additions will be more clearly apparent. Note the temporary connections around the 6AE8 to enable the IF section to be checked and aligned. A pickup may still be used, connected exactly as before.

me that an artist in the studio strikes middle C" on the piano. He will gener- e an audio tone of 256 cps (cycles r second). This will modulate the car- r at this frequency, or cause the rength of the carrier to vary above id below its normal level 256 times a cond.

As far as the transmitter is concerned job is done. It now remains for the ceiver to respond to these changes id so reproduce the 256 cps note. But w is it to do this? Such a signal, en after having been selected by suit- le tuned circuits and possibly ampli- d will still be completely inaudible hen fed to headphones or speaker.

HE REASON

Why? Well, fundamentally, because ir ears just do not respond to such equencies (i.e., the carrier or radio equency). And if we cannot detect the esence of the carrier, we likewise can- t detect any variations in its strength. One way of visualising the problem to imagine that a positive half-cycle the carrier, which tends to move our rdrums (or the diaphragm of our re- oducer) in one direction, is followed rapidly by the negative half that, as r as the eardrum or diaphragm is con- rned the two occur virtually simul- neously. Thus, like the two elephants ying to pull down a tree but pulling opposite directions, they produce no ovement at all.

However, if we kill one of the elephants (i.e., remove one of the half cycles) the remaining one is now able to achieve something. Suppose, for example, that we suppress the negative half cycles by means of a rectifier. The remaining positive halves will now influence the reproducer diaphragm in one direction only.

Although it cannot respond to individual pulses, it can respond, comparatively slowly, to a succession of them if they all push in the same

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1 6X4 valve.
1 Miniature 9 pin socket.
1 Miniature 7 pin socket.
1 7 tag terminal strip.
1 5 tag terminal strip.
1 4 tag terminal strip.
1 3 tag terminal strip.
3 ⅜in. grommets.
2 ¼in. grommets.
Hook-up wire, 18 gauge tinned copper wire, 3 core power flex, 3 pin plug, nuts and bolts (2 countersunk for speaker mounting) solder lugs, solder &c.

RESISTORS
1 .5M potentiometer with single circuit switch.
1 .47M ½W.
1 4700 ohm ½W.
1 1500 ohm 3W.
1 100 ohm ½W.

CAPACITORS
1 32 mfd electro. 350PV.
1 25 mfd electro. 40PV.
1 16 mfd electro. 350PV.
1 .01 mfd paper 400V.
1 .0047 mfd paper 400V.

ADDITIONAL PARTS FOR THIS MONTH'S SECTION.

2 IF transformers Nos. 1 and 2 (Type J32 & J33).
1 6BH5 valve.
1 6AE8 valve.
2 9 pin miniature valve sockets, wafer type for preference.
1 4 tag terminal strip.
1 3 tag terminal strip.

CAPACITORS
2 .1 mfd 400V paper.
2 .047 mfd 200V paper.
1 220 pf mica.
1 100 pf mica.

RESISTORS
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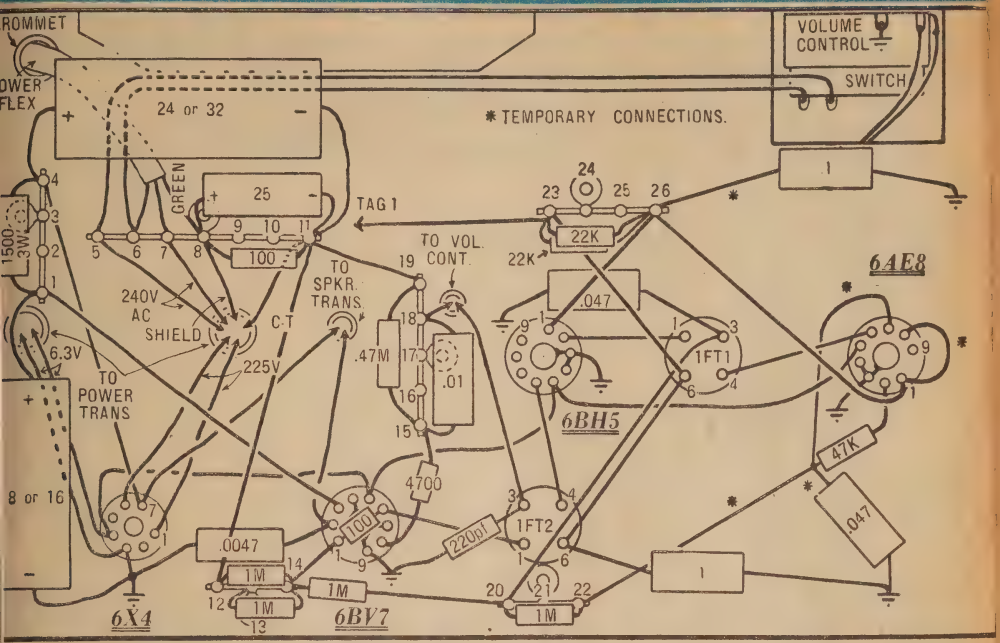
Ducon plain potentiometer from 10K—2 meg	7/4
Ducon potentiometers W/switch (500K and 1 meg.)	11/10
Mullard Hi Fi book	5/9
L.B. magnetic head book ..	3/6
Philips air trimmers 3-30 pf	4/6
Jabel compression trimmers	1/3

Custom Built **5 WATT AUDIO AMPLIFIER**, complete with 12in speakers **£19/19/6**

Call in and see our Mr. S. Hurrey. Let him solve your HI-FI problems for you! We are suppliers of LEAK, QUAD, WHARFDALE, ORTOFON, FERROGRAPH (etc., etc.) equipment.

THE COMPLETED WIRING SHOULD LOOK LIKE THIS



The additional parts and their positions are clearly shown in this wiring diagram. In particular it will enable correct placement and orientation of the valves and IF transformer, which are quite critical. Compare it with the circuit on page 49.

ection. Thus it will take up a position ermined, first, by the strength of the nodulated carrier, and then by what- r variations in carrier strength occur to modulation.

Where the detector is not fed dir- y to the reproducer its output is in form of a steady DC voltage when carrier is unmodulated, but varies ve and below this level at the mod- ting frequency, i.e., at 256 times a ond in the case of our "middle C" e.

PES OF DETECTORS

There are many devices which may used as a detector. The so-called ystal" used in crystal sets, small cop- oxide rectifiers, and the more rec- ly developed germanium "diodes" are ew. However, the most universally d device at the present time is loubtedly the two element, or diode, ve. This has many desirable charac- estics, not the least of which is the e with which it may be incorporated an almost free extra in virtually kind of valve.

Our 6BV7 is a typical example, being sified as a Duo (two)-Diode Power plifier Pentode. It is normally nded that one diode be used as a ector and the other for the gener- n of AVC voltage.

eference to the circuit will show we use such a diode in practice. 6 is the one employed and it is nected directly to one end of the IF transformer secondary. The other is connected to the cathode via a ly high value resistor, in this case .5M volume control. A 220 pf capacitor is connected in parallel with the volume control.

This resistor is called the "diode load" and sometimes may be simply a fixed resistor, the volume control being located elsewhere. However, this does not alter the operation of the circuit. The diode achieves its one-way-traffic characteristic by reason of the fact that electrons emitted from the cathode will cross the intervening space to the plate (thus completing the circuit) only when the plate is positive in relation to the cathode. While ever the plate is negative the electrons being also negative will be repelled

> The fact that our pictures must show brand names on components does not mean that only these can be used. Nearly all manufacturers these days make equivalent types of comparable quality. To illustrate the point, we have changed the make of power transformer from Ferguson to National in this issue. But it could have been one by Ironcore, A & R, Bramco, or any other brand with the same specifications.

If we assume that, at a particular instant of time, the upper connection of the IF transformer winding is positive and the lower one negative, then we may assume that the circuit will be complete and that there will be a flow of current through the diode load. Passing current through the resistor means that a voltage will be developed across it, with the cathode end positive and the winding end negative.

This condition will remain for as long as the plate is held positive, but immediately the next half cycle of alternating signal makes it negative, all current flow ceases. There will be no voltage developed across the resistor under these conditions, although the 220 pf capacitor will tend to maintain the voltage previously developed.

POSITIVE AGAIN

It is not until the diode plate swings positive on the next half cycle that voltage is again developed across the resistor, once again making the cathode end positive. Thus the only voltage ever applied to the resistor and capacitor is of this polarity, meaning that the incoming AC signal has been converted to DC.

As already explained, this DC will be constant only so long as the carrier is unmodulated. As soon as modulation occurs it will vary above and below the steady level at the modulating frequency.

Although manifesting itself as a varying DC signal, it becomes an alternating signal once again (but at audio frequencies this time) immediately we remove the steady DC and leave only the varying component. In this case the coupling capacitor (.01 mfd) between the diode load and the 6BV7 grid will have this effect, so that the grid is supplied with an alternating voltage at audio frequencies.

Since we have devoted so much space to the detector—but which we feel was justified—our discussion of the AVC and the IF amplifier will need to be

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE

DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

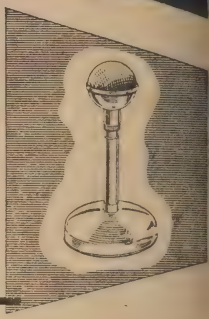
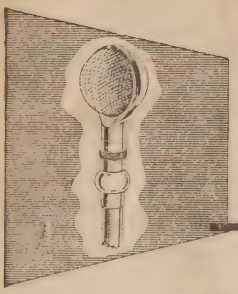


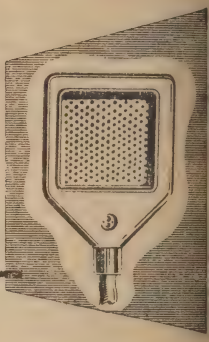
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE. £9/18/6.**



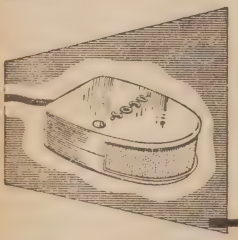
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



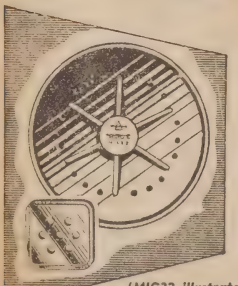
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**

CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as $\frac{1}{16}$ in. square to 1-$\frac{1}{16}$ in. round, with various thicknesses from $\frac{1}{32}$ in. to $\frac{1}{16}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

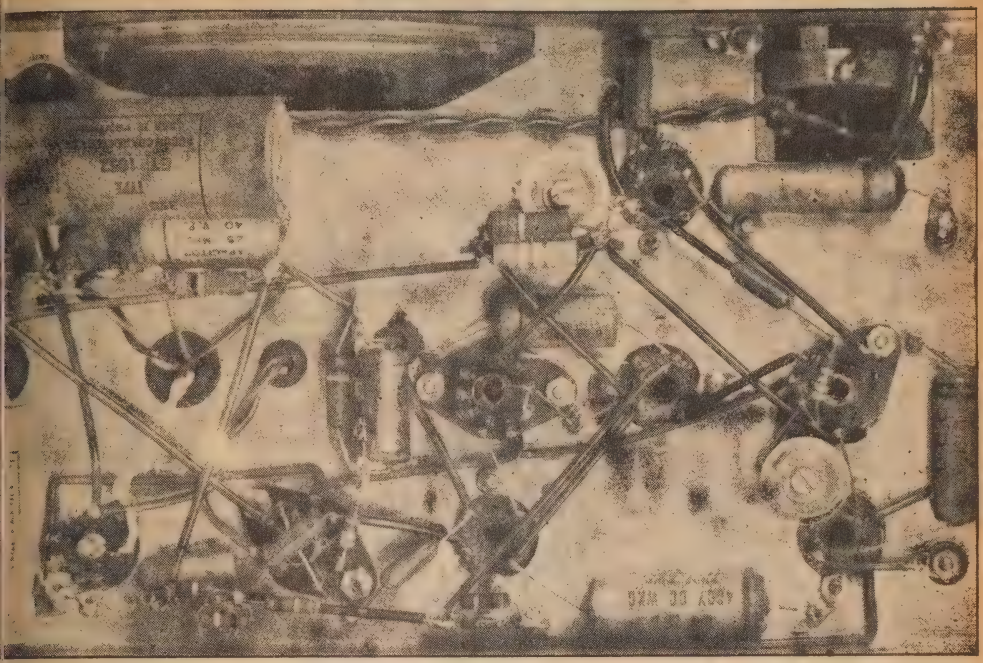
(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 101 Pyrmont Bridge Rd., Camperdown, Sydney, N.S.W. Phone LA 6124.

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

ADDITIONAL PARTS AND WIRING CLEARLY SHOWN



supplement the wiring diagram this underchassis picture gives an excellent idea of how the completed wiring should appear. Note that part of the wiring shown will not be fitted until next month.

. Fortunately, these are not hard to
w.
ie AVC uses the remaining diode
ie 6BV7 and, in fact, functions in
n the same way as the detector.
ever, the recovered DC is much
: heavily filtered, so much so that
audio component is removed and
output is proportional only to the
age carrier strength

W RESPONSE

elatively slow changes, such as
ed by fading or due to tuning from
station to another, are the only ones
h will produce any appreciable DC
ge. This voltage thus becomes a
convenient one for controlling re-
r sensitivity, which it can be made
o by applying it to the control grids
ne IF amplifier, converter and the
stage (when one is used).

ie result is to maintain almost con
volume from the set regardless of
ges in signal strength over a wide
e. This is not only convenient from
user's point of view but also helps
tain optimum signal strength in
ous parts of the receiver, particular
t the detector The manual volume
rol is still needed to set the output
ie desired level.

hd finally the IF (intermediate fre
icy) amplifier. Because of the diffi
of designing an amplifier which
work equally well over a wide
e of frequencies, such as the broad-
band, as well as possessing adequate
and selectivity, modern practice is
hange each incoming signal, as it
is received, to a new (intermediate) frequency.

This frequency may be selected by the set designer to give the particular performance characteristics he requires, and is usually lower than the lowest incoming signal. As an example, modern receivers use an IF of 455 Kc, meaning that any signal selected for reception is converted to this frequency before amplification.

We are not concerned at the moment with how this conversion is achieved—we will have more to say about that next month—but rather with the section of the set actually involved in the amplification process.

The IF signals first appear in the plate circuit of the 6AE8, the valve that actually performs the frequency conversion process. In this plate circuit is the primary winding of the first IF transformer (IFT1) which is accurately tuned to 455 Kc.

MAGNETIC COUPLING

Coupled to it magnetically is the secondary winding, also tuned to 455 Kc, and which feeds into the grid cathode circuit of the 6BH5. The coupling between the two windings (governed mainly by the distance) controls the gain and selectivity of the transformer and is usually a compromise between these two requirements.

As with the audio amplifier described last month, signals applied between the grid and cathode appear in the plate cathode circuit very much amplified. This brings us to the primary of the second IF transformer (IFT2) which is similar to IFT1. The signal which finally appears across the secondary is that which we apply to the detector.

While studying this part of the circuit note that the bottom end of the IFT1 secondary (lug 3) connects to the 6BH5 cathode (pin 3) via a .047 mfd capacitor. This provides adequate coupling at 455 Kc, while the DC return is via a 1M resistor to the AVC diode (6BV7, pin 1) and via another 1M resistor to the back bias system. This is the AVC network, which is also used to supply bias to the 6BH5 and 6AE8 valves.

CONVERTER AS WELL

(AVC voltage is also applied to the 6AE8, by means of a temporary connection for the present, but through the aerial coil when it is finished.)

Now we come to the actual construction of this section. Elsewhere you will find a new parts list detailing the additional parts required for this month's section. When these have been purchased you can get to work.

The main items are two more valves, sockets to suit, and the two IF transformers. As with last month's section, the first thing to do is to mount these on the chassis. Orientation is most important in this section and the wiring and layout diagram show exactly how these parts should be placed.

The two IF transformers are not absolutely identical, so they must be used in the correct first and second positions.

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Wavemeter

GM 3121

Range: 2.5, 260 M.C.

Accuracy: Better than 2%

Indication: Visual Neon or 'phones.

APPLICATIONS

- Frequency measurement 2.5-260 M/cs.
- Mod. or unmod. signal source 2.5-260 M/cs
- Determination of resonant frequency of circuit.
- Measurement of inductance.
- Measurement of capacitance.
- Tuning of HF circuit.
- Frequency measurement of antennæ.
- Neutralisation and others.

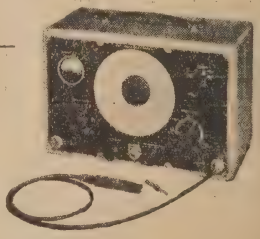
R. F. GENERATORS

Type GM 2893: 90 Kc/s—50 Mc/s

This unit has the extended range 25 Mc/s to 50 Mc/s to cover TV I.F. spot alignment.

Type GM 2883: 90 Kc/s—30 Mc/s

Incorporating: Turret band changing metered output. 270° illuminated scale expanded I.F. range 400 Kc/s-500 Kc/s.



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PHILIPS

PS701-57

he cans should be marked "No.1" and No. 2" to indicate this.

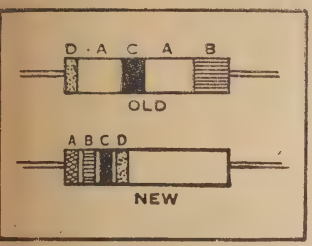
The terminal lugs are normally dentified by numbers but may be narked either additionally or alter natively with other symbols. While there nay be exceptions, the usual arrange ment is as follows: 1st IF (J32) Pin 1. rid. Pin 3. AVC. Pin 4. plate. Pin 6. IT. 2nd IF (J33) Pin 1. diode. Pin 3. iode load Pin 4. plate. Pin 6. HT.

CIRCUIT NUMBERS

Assuming you use the same types as n the original (J32 and J33) you will e able to work directly from the lug umbers given in the circuit and on the iring diagram. When mounting these ransformers, be careful not to exert nore than a moderate amount of pres ure on the mounting nuts. It is easy to ear the eyelet bolts out of the soft luminium can.

It is also a good idea to tin the ter minal lugs carefully before mounting, ince this will make it easier to solder he various leads to them later on. Some are is necessary here as the plastic ormer on which the transformers are vound has a fairly low melting point nd may be damaged if too much heat s applied.

Use a clean, hot iron, make sure the ugs are clean before starting, and use a mear of soldering paste if available.



The latter helps considerably in making quick application of solder. Be sparing with the solder, the idea being to tin he lug without blocking the small hole n it. Avoid exerting pressure on the ugs until they are quite cool.

The wiring is quite straightforward nd should take less time than last nonth's, particularly as you should have cquired some additional skill by now. As before, we suggest you make an at empt to work this out directly from the ircuit, using the wiring diagram merely o check any doubtful points.

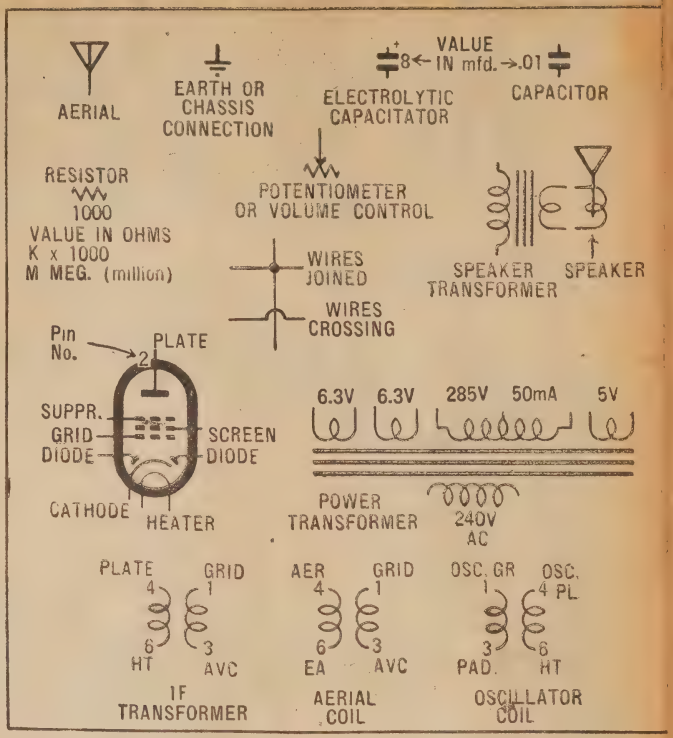
First connect the central shield of ach valve socket to pins 3 and 4, and hen to the chassis, at the same time onnecting these chassis points into the xisting earth network as described last nonth.

Now extend the filament line to pins of the two new valves, using the free ength of lead which was left connected o the 6BV7 last month and following he same technique as last month.

Next it may be best to concentrate on the additional connections to the BV7 and the 2nd IF secondary, since here are several small components to e accommodated round this part of he set. We will start with the de ector stage.

The free lead to the volume control, which you may have used as an audio nput point thus far, is now trimmed nd connected to lug 3 of the IF trans ormer, while a 220 pf capacitor by

THE MAIN COMPONENT SYMBOLS



Here are the symbols we gave you last month, plus the additional ones you will require for this and next month's section. The IF transformer is the main one this month, and the numbers and other markings shown should enable you to identify the terminals without difficulty.

passes this same point to chassis. Connect lug 1 to 6BV7 pin 6 and the detector circuit is complete.

RESISTOR COLOR CODE

Table showing popular preferred values of resistors in the R.M.A. color code.

Resistance in ohms	A	B	C
2200	Red	Red	Red
3300	Orange	Orange	Red
4700	Yellow	Violet	Red
6800	Blue	Grey	Red
10,000	Brown	Black	Orange
15,000	Brown	Green	Orange
22,000	Red	Red	Orange
33,000	Orange	Orange	Orange
47,000	Yellow	Violet	Orange
68,000	Blue	Grey	Orange
100,000	Brown	Black	Yellow
150,000	Brown	Green	Yellow
220,000	Red	Red	Yellow
330,000	Orange	Orange	Yellow
470,000	Yellow	Violet	Yellow
680,000	Blue	Grey	Yellow
1 Megohm	Brown	Black	Green
1.5 Megohm	Brown	Green	Green
2.2 Megohm	Red	Red	Green
3.3 Megohm	Orange	Orange	Green
4.7 Megohm	Yellow	Violet	Green
6.8 Megohm	Blue	Grey	Green
10 Megohm	Brown	Black	Blue

Next the AVC circuit. A 100 pf capa citor bridges 6BV7 pin 1 to pin 6 an sits conveniently across the underside c the socket. A 1M resistor connects be tween pin 1 and chassis and is sup ported between tags 13 and 14. Anothe 1M is mounted between tags 12 and 1 a lead between tags 11 and 12 servin to connect this to the back bias poin

Finally, a third 1M resistor connect to the junction of the two previous re sistors (tag 14) and thence to tag 2(Note particularly that all leads to pin must be as short as possible, being con fined to a short length of tinned coppe wire between it and tag 14, with "a three resistors connected as close to th latter as possible. The length of lead as sociated with the opposite end of eac resistor is not particularly critical.

From tag 20 a lead connects to lu 3, 1st IF transformer, while another 1M resistor is mounted between tags 20 an 22. A lead from the latter point connect to pin 7, 6AE8 and a 47K resisto Tag 22 and lug 3, IFT1, are by-passe to chassis by .047 mfd paper capacitors This completes the AVC circuit.

Next we can complete most of th connections to the IF transformers Some of these are best made with bar tinned copper wire and as short an direct as possible. These are: lug 4 IFT2 to pin 6, 6BH5; lug 1, IFT1 t pin 2, 6BH5; and lug 4, IFT1 to pi

(Continued on page 127)

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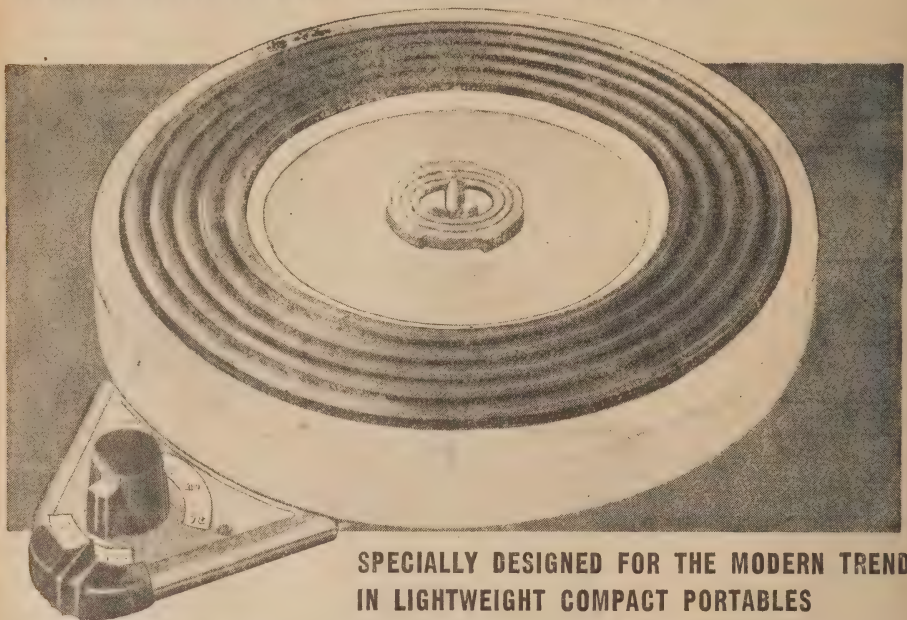
NEW **BSR TU9**

4-SPEED TURNTABLE UNIT AND PICK-UP



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The TU9 Pick-up Arm gives amazing PERFORMANCE ***(suitable for both mains and battery units).***

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TU9 Mains Motor and Turntable Unit
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FROM THE SERVICEMAN WHO TELLS

Every now and then I find it necessary to have a general clean up and sort out items previously put aside for lack of room, a need to check some of the points raised, or some other minor difficulty. This is one of those times, so there is more variety than usual this month. A couple of readers' letters, a couple of Press items of doubtful accuracy, plus the usual workshop problems.

The first letter comes from Mr H. L. , of Elizabeth South, S.A., and conrns my remarks in the March issue garding defective picture tubes. In par-ular he comments on the suggestion at a heater-cathode short may be overme by simply employing a one-to-one ater transformer to isolate the heaterthode combination from the early ater line. He says:

"Whilst this is true it must be borne mind that the primary to secondary, d secondary to frame capacitance ust be as low as possible, otherwise vere attenuation of the higher video equencies will result with consequent ss of definition. This capacitance can quite high—200 pf or so—and to re-ce this to a reasonble figure requires ecial transformer design.

"This fact was overlooked by many rvicemen in the United Kingdom and ien realised led to the appearance of w inter-winding capacitance transrmers.

"I trust that this information may be use to your readers and possibly the insformer manufacturers."

NTERESTING POINT

Well, many thanks Mr H.L.A. for ising this point, which seems to have en overlooked in a lot of the data iblished so far, and I must confess that overlooked it myself when discussing e problem.

In fact, this problem is perfectly ob-ous, and I remember walking into the F and H workshop a few weeks ago find a couple of the staff members gaged in this very problem. In this se it was a 5BP1 CRO tube which is involved, and which they wished to e for a 5in TV set. Since the heater d cathode are bonded, an isolating insformer is essential if video is to applied to the cathode.

Since standard transformers had oved useless, they were engaged in oducing one of their own. Unfortunate-I was unable to follow the experi-ent to its conclusion, but the general ture of the problem was obvious ough.

Of more immediate importance is the estion of just how much capacitance n be tolerated in such circuits and w far transformer designers can go in ducing this to a desirable minimum.

PICAL FIGURES

While I have no actual figures to ote for such special transformers, I ve made some measurements on typi-d stanrdard heater transformers which uld seem to vary between about pf and 150 pf. The larger figure uld almost certainly produce an in-erable degradation, even for the not-critical viewer.

The smaller figure is more debatable, though there is no question that suddenly adding 50 pf to the video circuit of a typical receiver noticeably degrads the picture—I know, I've just tried it. On the other hand it probably makes a good set no worse than some of the worst sets one sees around and may be acceptable to some people, at least on an emergency basis.

However, since these were standard transformers, I should imagine that special design should enable at least half the lower figure to be achieved; possibly even lower, and reducing the order of degradation by a like amount.

DEBATABLE

Once again, the effect of such a figure is a matter for some debate. The most critical enthusiast would probably still be disturbed by it, but it may well pass unnoticed by the average viewer, if only because he would not be aware, unless told, of the possible consequences of the change. But, in any case, he would probably be prepared to accept it on the basis that a degraded picture is better than no picture — particularly where a limited budget leaves little choice.

And that would seem to be its position in the scheme of things; a method not without its limitations, but a perfectly acceptable one where a new tube is out of the question, and assuming that all possible precautions are taken to reduce the losses to an absolute minimum.

My next letter also concerns TV, being a particular case as related by a reader and fellow serviceman from Victoria. His letter is reprinted in the accompanying panel. I suggest you rea it before proceeding further.

Unfortunately, my correspondent omits to mention the type of aeria used, but my bet is that it was one o the simple indoor type. This, combine with a lower than average field strengt on the channel concerned, could easil give rise to all kinds of problems assoc ated with insufficient signal strength.

In fact, it is not unusual to fin that metal venetian blinds can caus a lot of trouble when these simple in door aerials are used. After havin spent a lot of time determining th optimum placing and orientation o such an aerial, to suit all channels it can be very disconcerting to discove that the whole thing can be ruined b simply raising or lowering a singl blind.

PUZZLING FEATURES

In this case, a full explanation o all the effects noticed may prove rathe difficult. Assuming a serious drop i signal strength, the need to retune the oscillator slug is probably explained b the fact that most local oscillators wil shift in frequency by a noticeable amount with the application of varying A.G.C. voltage. Thus the combination of reduced signal voltage and the detuning which it brought about could result in almost complete loss of the channel.

The distortion is not so easy to explain. Most conventional sound IF channels and discriminators are virtually immune to changes in signal level even though, theoretically at least, it is de-

Dear Sir,

The most unusual TV "condition" in my rather short experience occurred today. When the client phoned to say that his set had no sound on Channel 9, I had visions of a very easy service call.

However, as Burns said: "The best laid plans of mice and men so often go astray." Everything appeared to be going according to routine when, after removing the knobs and inserting the usual knitting needle, I managed to bring in picture and sound of the offending channel.

Instead of the end, this was just the start, because, to my astonishment, the sound was quite distorted. Adjusting the discriminator slug was of no avail so I removed the chassis and placed it on top of the cabinet, the latter protected by a suitable mat. (This saves back-ache.)

After the usual valve swapping and voltage check the trouble was still not located. Unfortunately the other two channels were not transmitting at the time and, when the offending channel went off the air, an evening call was required.

At this later visit (bang goes the profit!) only Channel 9 was found to be faulty, and so I started to look outside the set. Nearby was an "O" gauge train set with the lines making all sorts of loops. Enquiries revealed that this had been placed in the living room about the time the set started to play up.

Well, you can guess the rest. The train set was hastily banished to an adjoining room and I was able to go merrily on my way. Apparently the dimensions of one of the loops were such that they collected and re-radiated a signal out of phase with the signal collected by the aerial.

TV technicians may not be psychic, but they are certainly psychiatric!

Yours faithfully,
L.W.D.

All the better to hear with!

SOUND LEVEL INDICATOR TYPE 1408

—a product of DAWE Instruments Ltd.

THIS COMPACT INSTRUMENT PROVIDES A SIMPLE MEANS OF DETERMINING SOUND LEVEL AND COMPARING THE INTENSITY OF SIMILAR SOUNDS.

Features of the TYPE 1408

- Small enough to be held in one hand.
- Direct reading.
- Self-contained.
- Easy to operate.
- Tripod fitting.
- Robust.

Ever increasing mechanization is bringing into daily use more and more machines and equipment all of which are potential producers of noise. In many establishments noise has risen to such a level as to cause annoyance, irritation and lack of efficiency, and is fast becoming a major problem for the medical profession.

Architects, builders, engineers and designers are now aware of this problem and energetic steps are being taken to combat noise. To carry out such work, however it is essential to have an accurate means of measuring sound levels since the human ear is notoriously unreliable in this respect. It will, for example, give the impressions that a particular machine is noisy in quiet surroundings but quiet in noisy surroundings; it is also incapable of retaining any reliable impressions of sound intensity even for short periods of time.

Measuring the exhaust noise of a motor-cycle with the Sound Level Indicator.

The Type 1408 Sound Level Indicator provides a simple means of measuring sound levels and does not suffer from the vagaries of the human ear. It is small enough to be carried in the overcoat pocket and is an essential part of the installation engineer's kit.

Heating, ventilation, refrigeration, lift and automobile engineers are finding this instrument invaluable, whilst to architects and builders entrusted with the reduction of noise it is an essential tool.

SPECIFICATIONS

Design. The Sound Level Indicator is a simplified version of the sound Level Meter Type 1400. It comprises a sensitive crystal microphone, a calibrated adjustable attenuator, high gain amplifier with three weighting networks, an indicating meter and self-contained dry batteries.

Range. 30 to 135 dB above standard reference level of 0.0002 dynes per sq. cm. at 1000 c/s.

Frequency. Three standard frequency characteristics are available, corresponding to 40 dB, 70 dB, and "Flat" weighting curves. Under the latter condition, the response is substantially level from 40 to 6000 c/s.

Microphone. Self-contained diaphragm type crystal microphone.

Attenuator. Variable in 10 dB from 40 to 130 dB.

Meter. Calibrated for —10 to +5 dB.

Power Supply. Operated from self-contained miniature batteries.

Mounting. Light-weight black leatherette covered metal case. Provision for tripod mounting. Supplied complete with leather carrying case.

Dimensions. 8¼ in. x 3¼ in. x 2¾ in. overall.

Weight. 2¼ lb.

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sirable to drive the limiter stage sufficiently hard to ensure reasonable noise rejection and adequate band-width.

I can only assume that the condition was one peculiar to the particular type of set, and was the result of some random condition which would only be revealed by a careful examination of the set under similar conditions, artificially produced if necessary.

Maybe some other readers may have had similar experiences.

My next comment concerns a par which appeared in one of the TV program review pages of a well known women's magazine. (In case readers imagine that I spend my spare time scanning such literature for technical errors, let me hasten to state that I don't. Mrs Serviceman does it for me — and most efficiently too.)

SUNLIGHT DANGEROUS

The par referred to read " . . . .do see that you don't get any direct sunlight on your screen — ever. I hear it does dreadful things to those expensive tubes."

At first glance this statement has all the appearances of being just another old wives' tale with a modern twist, and I was momentarily inclined to dismiss it as such; particularly as I had never seen reference to such a problem in any text book.

It seemed more likely to be a badly garbled version of a warning I heard voiced by manufacturers around the time production commenced in this country, and when the whole subject of picture tube life was being pretty thoroughly thrashed out.

This was to the effect that the life of a tube could be prejudiced by OPERATING it in bright light, since the natural tendency was to turn the brightness up to a very high level in order to secure a worthwhile picture. Such treatment, for long periods, could reduce the tube life.

Then I had a second think about it. I remembered an occasion on which a colleague and myself were working with some ordinary C.R.O. tubes and noticed how they could be made to glow quite brightly in a darkened room without any apparent energisation. All that was necessary was to expose them to bright artificial light beforehand.

A PRACTICAL USE?

My colleague, being country born and bred, immediately suggested that the phenomenon might be developed to the point where it could replace the hurricane lamp for journeys into the back yard on dark and stormy nights. But, as far as I know, his scheme never progressed beyond the laboratory stage.

However, his facetious suggestion had served to impress the incident on my memory and it now occurred to me that it might have some significance in regard to the current poser. If light was produced from a fluorescent screen, regardless of the source of energy, was there not a possibility that the life of the screen would be reduced in direct proportion? And, if so, would the amount of light produced be significant and likely to reduce the screen life by any appreciable amount?

Not being able to answer such questions myself, I sought out an acquaintance who is an engineer at one of the local valve companies and put the story and my own theories before him. Was this another groundless rumour or was there really something in it?

My friend had no hesitation in stating that there was, in fact "something in it." He confirmed my theory that the presence of sunlight on the screen would cause it to emit light and that this emission represented a portion of the normal life of the screen.

On the other hand he hastened to qualify these remarks in relation to the original problem—the actual life of the tube as it might be affected in practice. First he confirmed that it would need to be direct sunlight, not merely reflected sunlight as normally found in an average room.

Then he gave it as his opinion that the tube would need to be exposed to this light for several hours every day for several weeks in order to produce any appreciable loss. And, finally, that the sunlight of early morning and late afternoon would be far less dangerous than that for the period approximately two hours before and two hours after midday.

The reason for this is that the screen is excited mainly by the violet and, more particularly, ultra-violet portions of the spectrum. These are most pronounced during the hours of midday and least in the early morning and late afternoon.

I also raised the point concerning the effect of high ambient light on the brightness setting when the set was actually in operation. He was quite emphatic that this was a really undesirable condition and that, if allowed to occur consistently, could cause far more deterioration than the mere presence of bright light on an inactive screen.

In summary, then, the position would appear to be as follows:

Occasional exposure to sunlight would seem to be quite harmless, even for a period of several hours. However, a combination of lounge room windows and set placement which allowed the morning and/or afternoon sun to shine on the screen for several hours every day would seem to be unwise. Simply lowering the blinds on the offending windows would solve the problem, and there would be no need to panic if this were neglected occasionally.

THE LADY WAS RIGHT

So there it is. The lady was right (for once), though only just, and I feel that her plea for caution was probably a trifle exaggerated. Nevertheless, it is an interesting point, if only because no one seems to have raised it until now.

The next news item is in a completely different category. Carrying a Paris date line it reads as follows:

"A simple device for getting three-dimensional images from standard television sets was ready for mass production, an inventor said today.

"The inventor, Marcel Espinasse, of Toulouse, said the device used mirrors and would sell for about £

"One mirror, cut in what Espin calls a 'certain mathematical shape, placed in front of the television at a 45 degree angle. It reflects image up to a second mirror attac to the top of the set.

"Viewers looking at the second mi would see the screen image in th dimensions." Espinasse said.

I suppose while ever we have we will have "inventions" of 3D vices, just as we get a rash of th in the motion picture industry at re lar intervals, but this new story take a lot of beating.

For my money, our French friend cut mirrors in "certain mathemat shapes" until he's black in the f and he still won't produce a three mensional picture from what is basic a two dimensional image. In fact, "mathematical" approach would be better directed to a study of basi optical laws, something about wh these "inventors" seem to be woefu ignorant.

How they expect to achieve sor thing in complete defiance of these f damental principles is something I never understand. Either they are tremely naive and honestly believe th their unorthodox methods have so chance of success, or they simply ha no qualms about foisting any kind gimmick on the general public.

KNOWS NO BETTER

In this respect they are probably fairly safe ground, since the man in street normally knows less about subject than they do. Faced with impressive looking gadget of some ki and some slick sales talk, he can eas be kidded into believing that he rea is seeing a 3D image. By the time wakes up (if he does) he has boug the gadget anyway, so the "invento has nothing to lose.

(Or should that be Toulouse.)

Coming back to the mundane m ters of everyday work, I have a n intermittent story to relate. The set w a regular five-valve chassis from one the older, larger, mantel cabinets, a using the 6J8, 6U7, etc. Octal seri

The owner complained of a "crac ling" sound, and I managed to esta lish that it was intermittent in natu but he was woefully vague concerni any other details. All he could tell was that " . . . it just seems to do at odd times."

All of which was not much he so I slipped the chassis from the ca net, switched it on, and gave it a qui "once over." It seemed to function qu well, and a bout of preliminary pro dings and gentle bashings revealed no

☆

"This is the knob that's been giving us all the trouble!"

☆

ANOTHER REASON WHY ONLY

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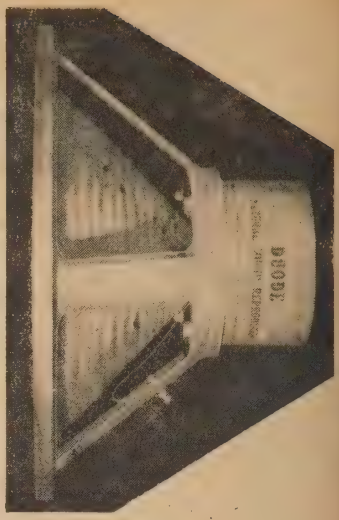

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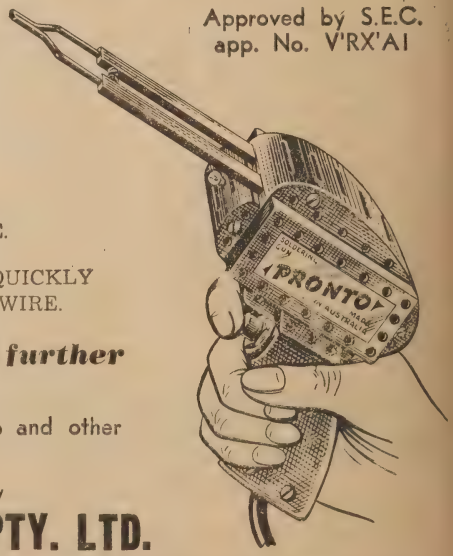

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ng in the way of loose or noisy components. So I simply set it up on the corner of the bench reserved for such sets and let it run until something showed up.

After a couple of days, during which time I had bashed and prodded it at odd intervals, I was no nearer the solution. There had been no odd noise of any kind.

I was beginning to think that the trouble was one of local interference and that I might have to do some on-the-spot checking; something which can be very time consuming unless one has a good deal of luck.

I gave the chassis a complete routine check, could find nothing wrong with it, and slipped it back in the cabinet. I'm not exactly sure why I did this, except that I had an idea I might have to take it back and check it in its own location, plus a vague possibility that a check in the cabinet might reveal something.

PROMPT RESPONSE

However, I didn't really expect any results, and was rather surprised when the set suddenly commenced to give forth a rather erratic rustling, crackling sound, which seemed to match the owner's description. Determined to get to it before it cut out, I paused only long enough to check the effect of the volume control before whisking it out of the cabinet again.

The volume control had no effect, thus locating it in the audio stage, but no sooner was the chassis out of the cabinet than the trouble ceased in a most frustrating manner. Somehow it seemed too much like coincidence that the trouble only occurred when the set was in the cabinet and, remembering last month's portable, I began thinking in terms of heat sensitive effects.

I could have put it back in the cabinet for another test but, on an impulse, I picked up a large, heavy cloth that was handy on the bench and draped it over the chassis. Sure enough, within minutes of doing this, the crackling and rustling returned, only to vanish again almost immediately I lifted the cloth.

In fact, the whole situation was bordering on the ridiculous. I could make the noise either appear or disappear by draping the cloth magician-wise over the chassis, yet there seemed to be little chance of my coming to grips with it while ever I had to keep the set wrapped up like a Christmas pudding.

CREPT UPON IT

Gently lifting one corner of the cloth I managed to keep the noise going while I located and extracted the 6B6 audio valve. The noise vanished immediately, suggesting that it must be somewhere in this stage, since the volume control test had eliminated the earlier stages.

While realising that it could be many things, the valve seemed the easiest to check, and I simply plugged in a spare. After several minutes operation — still wrapped up in the cloth — there was no sign of the trouble, and I began to hope I had struck it in one.

I plugged the old valve in again and the noise started shortly after it had warmed up, but the new one back in the socket completely cured the trouble. I swapped the valves back and forth several times, each time with the same result. As far as I could see there was no doubt about it.

After a final run in the cabinet for

Continued on Page 124

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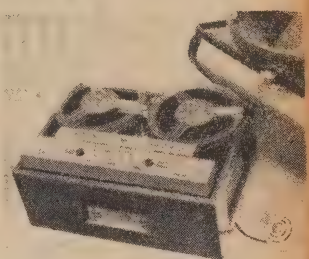

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BATTERY CONVERTER COIL DATA

Here is a set of coils for a recently described battery short-wave converter. Designed to cover from 2 to 7 Mc., they may be simply substituted for the original coils or, if you desire both bands, a switching arrangement may be provided.

Ever since we described our battery ort-wave converter in the February ue, requests have been coming in for il details to cover the range between e normal shortwave and broadcast nds, that is from approximately 2 Mc 6 Mc.

The addition of this band offers many teresting programs from Africa and uth America, as well as from the ntinent. More important to local untry listeners, however, is the fact at several ABC shortwave outlets are cated near the 6 Mc position.

For bushfire work, frequencies be-veen 2 and 8 Mc are being made ailable and, in consequence, a number readers have asked for the added cility of being able to monitor these ansmissions, as well as listen to normal ort-wave programmes.

Other services also use this part of the ectrum and although of limited use-lness to the average listener, they ay have entertainment value for the ved-in-the-wool ether-searcher.

With the larger coils in circuit, the ning range of the converter takes in vo amateur bands, one on 3.5 Mc. and e other on 7 Mc. This last extends 7.15 Mc. and can be covered readily ovided the trimmers are not screwed too far.

A comprehensive description of the nverter was featured in the February 957 issue, together with the photo-aphs, parts list etc. For those who ve missed this issue, back copies are ailable through our query service.

Briefly, a short-wave converter is a equency converting stage, tuned to ceive one of the short-wave bands. stead of producing the conventional of 455 Kc., it produces a frequency mewhere in the tuning range of the oadcast receiver to which it is coupled. he actual figure may vary, a vacant ot being selected at about 1600 Kc.

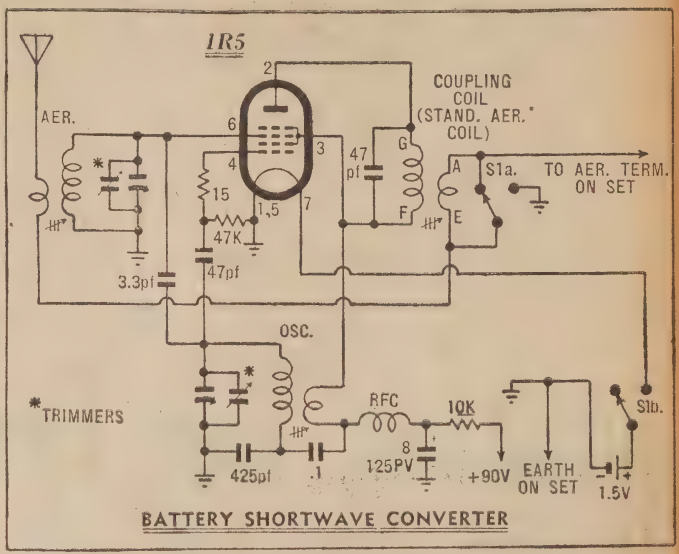
Used with a standard broadcast re-iver, it transforms it virtually into a uble-change superhet with improved nsitivity. The double-change principle also useful in image rejection, placing e image at twice the new inter-ediate frequency away from the funda-ental signal.

Reference to the circuit shows that ere is nothing unusual about it, being rtually the converter stage of an ord-ary battery receiver. The components ed are all quite standard and readily ailable through the normal channels.

As in the original, the new coils are and wound on polysterene formers, though in this case ungrooved formers e to be preferred. Adjustable iron-dust res are also fitted.

Diagrams giving the essential details n the coil winding are reproduced and o difficulty should be experienced in e winding of the coils.

To align the completed unit, connect to a receiver. Tune the receiver to bout 1,600 Kc, feed an appropriate



BATTERY SHORTWAVE CONVERTER

signal from an oscillator or a station and adjust the core of the coupling coil for maximum signal strength. The spot chosen on the receiver dial should be free from broadcast signals to mix with shortwave signals. Also do not place the converter directly beside the receiver, a separation of one or two feet being desirable to minimise pickup of harmonics from the receiver's own local oscillator.

Leaving the oscillator coil core set half way, tune the converter and signal generator to a suitable signal near the low frequency end of the band. The aerial coil may now be adjusted for a peak. If one cannot be found, it may be necessary to reset the oscillator slug.

A similar procedure is adopted for the high frequency end of the band, this time peaking the aerial trimmer. Again if it is not possible to obtain a peak the oscillator trimmer may have to be reset.

The actual position of the stations on the dial is set by the oscillator adjustment.

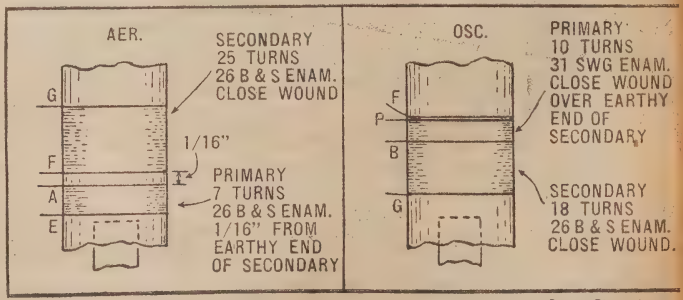
At the high frequency end of the dial the oscillator trimmer will have the greatest effect on station setting—at the low frequency end of the band, the adjustable core in the coil. Each time these are changed, the aerial trimmer and iron core should be readjusted to provide the loudest signal.

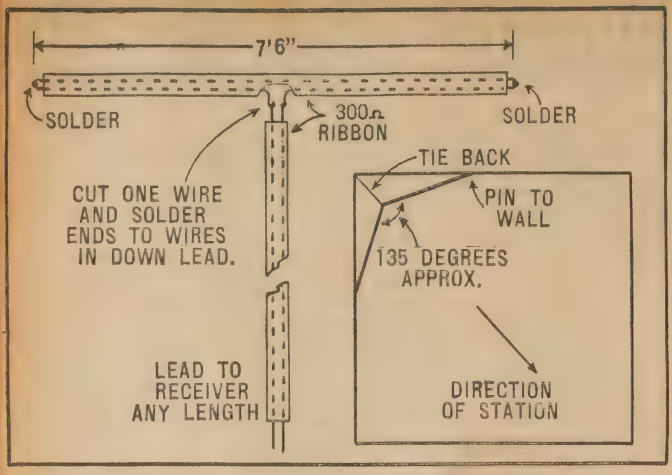
In all cases the oscillator is set to the high frequency side of the signal.

A word of warning on lining up with a signal generator may not be out of place. When shifting over from the low frequency end of the band or vice versa the receiver and the generator should be walked across in step to prevent the possibility of crossing over to the image frequency somewhere along the band.

Crossing over to the image frequency will completely upset alignment and apparent band coverage.

(Continued on Page 121)





Don't try to test your television receiver on a signal picked up by a stray piece of wire. If a proper aerial installation is not ready, at least make up a dipole from 300-ohm ribbon, as shown above.

Do not disturb any other adjustmen unless you do so as part of a planne alignment procedure.

When it comes to air testing the com pleted receiver, the problem of an aeri arises automatically. The fact that th receiver may previously have operate on sound only with some makeshift se up is not conclusive, since the sign requirements for a good picture a much more exacting than for acceptab sound.

PROPER AERIAL?

Undoubtedly, the ideal is to have a aerial ready for the receiver, instead trying to rely on the signal pickup fro odd pieces of wire. Ghost effects, poo picture locking and "noise" are only be expected under such conditions, ma ing it very difficult to evaluate the tr performance.

If you have to rely on a temporar aerial, at least make up a resonant fol ed dipole from 300-ohm ribbon, whic can be pinned to the picture rail other woodwork in the room. Dime sions for such an aerial are given in th accompanying sketch.

Its position in the room for best si nal is likely to be affected greatly b electrical wiring, metal blinds, met furniture and such like but, for a sta

Adjusting Your 1958 TV Set

Having completed the TV receiver, the next step is to put it into operation and carry out adjustments with a view to obtaining the best possible picture on the screen. This article explains the important adjustment procedures and also details a few possible amendments which will interest those who like to experiment. Most of the information is applicable to the earlier R. TV & H. Television receivers.

Undoubtedly, the most important single operation in adjusting a new receiver is alignment of the IF strip, preferably in association with the tuner. We had something to say about this in the first article and the wise reader will have planned ahead, in the light of our earlier remarks.

If the IF strip is a pre-aligned unit, it will need only to be installed and steps taken to see that the adjustments are not upset by vibration or by tampering. Ideally, the strip should be given a final "touch up," either upon completion of the sound section or, if portability is no problem, after the receiver has been completed and otherwise adjusted.

AFFECTS ALIGNMENT

The point behind this last remark is that the output coil in the tuner is virtually an IF transformer and its adjustment can have a marked effect on the overall shape of the selectivity curve.

With a home-made IF strip, alignment will be essential at one stage or another. We have heard of cases where non-aligned strips have produced picture and sound immediately but picture quality and alignment are so intimately related that one cannot be truly assessed until the other is completed.

Parts suppliers with alignment facilities will need no further instructions about how the job should be done, since alignment data is normally available from manufacturers of strips or the coil kits to build them.

The same data should assist those who plan to attempt their own alignment. We may have more to say about alignment of the Mark III IF strip in a later issue, depending on space and time but the bulk of the present article is devoted to other matters, some of them not previously discussed in this journal.

One point only will be made. If, prior to final alignment, the sound is present but is distorted, the chances are that the discriminator transformer is misaligned. Identify the core of the secondary winding from manufacturer's data and try screwing it a half turn or so either way, until a setting is found where the distortion disappears.

by *Neville Williams*

it should be pinned so that it forms shallow "V," with the interior cent line of the V facing the station.

Better still, the aerial can be stru appropriately to the rafters under a no metal roof, but clear of electrical wirin plumbing and the hot-water tank.

ORDER OF SIGNAL

The pickup of such a aerial is nev as good as that of a multi-element ty erected in the clear above the hou Do not be disturbed, therefore, if so "noise" interference on the picture still evident on Channels 7 and 9. will probably disappear later, when better aerial is installed.

The choice of this "better aerial" w depend largely on the district and t constructor can well be guided by typ favoured in the immediate vicinity. T much signal can be as embarrassing too little and, with this in mind, o servations are made on the facing pa about overload symptoms and the u of attenuator pads.

Now for the receiver itself.

To assist those who may have co pleted their receiver before this iss came to hand, we included, last mon brief instructions for setting the fra and line hold controls. These instructio are repeated here and amplified som

) that the adjustment information ibstantially be complete in one

n the receiver is switched on for t time with the picture tube in n, the initial operation is to set trap magnet so that the bright- e appears on the screen for any letting of the Brightness control. n trap can be adjusted more y later, when a stationary picture able.

the Frame and Line Hold poten- rs in their mid-positions, tune the to an active Channel, as evi- by the presence of sound. If you tunate, the picture may lock im- ly but there is an even chance will not do so, the screen being a violently flickering pattern of se lines.

E, LINE HOLD

ing the Frame Hold potentio- hould stop the flickering and ver- ovement, indicating that the s now locked at frame frequency. just be necessary to vary the ine control to achieve this con- because, as stated earlier, the is much more sensitive to tun- n sound.

ing the Line Hold potentiometer now reduce progressively the of transverse dark lines across een, until the picture suddenly nto lock. If it does not, screw the the Horizontal Oscillator coil cture lock is achieved. If the still does not lock, screw the core Sine Wave coil in or out by a of turns and try the Horizontal or core and the "hold" pot again. g obtained a stationary picture, us control can be adjusted for focus, as judged by the scan- es. You will find also that slight nts of the ion trap magnet will cus and it can be set accordingly, that it does not involve a posi- were the brightness is noticeably

is juncture also, the effect of ning can be observed. This con- lf may need adjustment later normal tendency is for the pic- break up into streaks, keeping th the sound, with the control o one extreme. At the other ex- he picture tends to lose detail sound grows somewhat weaker.

G POSITION

t tuning position is normally lear of the position where streaks or "sound bars" are t. Make all subsequent adjust- with the receiver tuned in ashion.

me stage during the adjustment e, the range of the Fine Tune may need to be modified to off- initial inaccuracy of the tuner or or oscillator shift with different g voltage. Whether it is done the piece or after other matters en attended to is of little con- .

r é sake of convenience, the tuner e adjusted so that all channels ived best with the Fine Tune a central and easily recognis- ition. Tuning therefore becomes ely a matter of turning a switch.

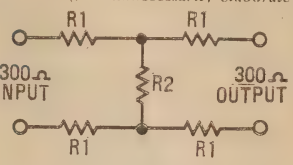
TV AERIAL ATTENUATOR PADS

OVERLOAD, due to excessively strong input signals, is a fairly common occurrence with television sets, both commercial and home constructed.

Possible effects of signal overload include high and uncontrollable picture contrast, picture tearing and rolling and frame buzz on the sound channel.

It can also aggravate spurious interference effects in the picture, ranging from erratic criss-cross patterns to the fine herringbone effect caused by the 5.5Mc intercarrier beat.

In many cases, overload results from using an unnecessarily elaborate aerial in a strong signal area, the trouble being most pronounced, as a rule, on Channel 2. If there are no complicating factors, it may not be necessary to do any more than point the aerial somewhat away from the transmitting masts.

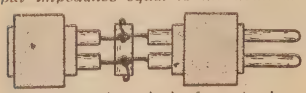


Attenuation	R1	R2
6db	47Ω	390Ω
10db	82Ω	220Ω
20db	120Ω	68Ω

Here is the circuit and values for pads having three degrees of attenuation. The circuit assumes that carbon resistors are used and that signals are not bridged across the pad by having input and output leads too close together.

In other cases, a substantial, highly-directional aerial has been necessary to eliminate ghost problems, excessive input signal being introduced as an inevitable result. In such a case, it is clearly not practical to point the aerial in any direction other than the one which gives least ghosting, signal strength notwithstanding.

In such a case, the best course is to make up a resistive attenuator pad, which can be installed between the feeder and the point where it normally connects to the receiver. Provided the pad has an input and output impedance equal to the nominal impedance of the feeder system, it will attenuate the input signal without upsetting the directional qualities of the aerial.



A suggested method of construction using Belling-Lee type aerial connectors.

The accompanying diagram shows the circuit arrangement for a balanced 300-ohm pad, with resistor values giving three different degrees of attenuation.

The optimum pad, for any individual situation, is the one which just obviates overload effects from the strongest station, generally on Channel 2, without causing "noise" to intrude on the weakest channel, usually either 7 or 9.

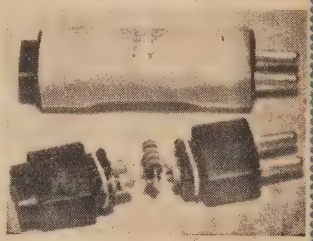
A few practical tests have suggested that the 10db pad is the one most likely to be of use. If a test suggests that more or less attenuation is desirable, a second pad can be made up for a few shillings.

The diagrams and photograph illustrate a typical method of constructing a pad, so that it can be plugged directly in series with the lead-in. The one illustrated uses the Belling and Lee connectors suggested for R, T & H receivers but a similar method could be used for other types, which individual makes of receiver may happen to use.

Carbon resistors should be used for the pads to avoid inductive effects. We used Morganite brand miniatures, which are certain to be carbon. The manufacturers of IRC resistors advise that their BTF ½W types, within the range required, are likewise carbon, though some of the older and larger patterns are wire-wound.

To make the pads illustrated, we gripped the respective male and female sections of the connector in a vyse and, having trimmed the resistor leads short, spotted one resistor into each of the four contacts.

The two sections were then placed end to end and the pigtails of the centre resistor bent around to encircle the free ends of the others as illustrated. A couple of spots of solder and everything was held firmly together.

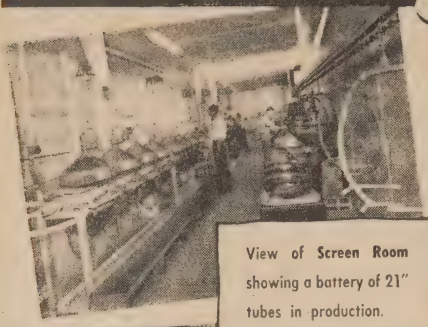


Typical pads, as first assembled, and when pushed inside a snugly fitting section of PVC tubing.

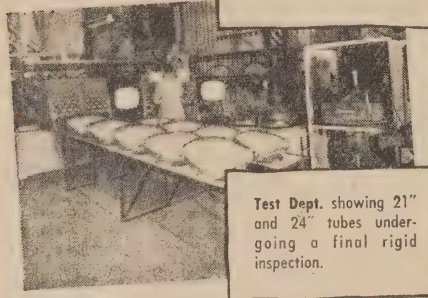
To finish off the pads and strengthen them physically, the assembly should be wrapped in low-loss electrical tape or else enclosed in a scrap of large diameter PVC tubing, softened in hot water and pushed over the top (16mm is almost ideal).

As an alternative, the pad could obviously be terminated with scraps of 300-ohm ribbon, for twisted connection into the feedline or else built into one or other of the aerial connector boxes designed for screwing on to the skirting board.

Your Eyes — will make you Screen wis



View of **Screen Room** showing a battery of 21" tubes in production.



Test Dept. showing 21" and 24" tubes undergoing a final rigid inspection.

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ir own home-built tuner, it is
to spread or squeeze the os-
ils slightly to gain the desired
ommercial tuners usually pro-
adjustments for the purpose.
Mullard and Philips type, used
totype receiver, the procedure
the Fine Tune at about mid
which then makes it possible
non-metallic screwdriver tip
hole to engage the core of
tor coil in use. This can then
to give the required tuning

**tect the delicate cores and
he screwdriver must be filed
slot accurately and the core
thout exerting any more than
n of end thrust.**

ng a stationary picture is only
tep and the relevant adjust-
ist be rechecked to obtain
rly correct operation of the
oscillator circuit.

ONTROL CIRCUITS

g that no oscilloscope is
the procedure is as described
n.

Line Hold potentiometer at
ance, preferably with the aid
meter and then short out the
coil with a length of wire.
throw the picture temporarily
ch.

he core of the oscillator coil
cture locks once again, then
he total number of turns
hich the core can be rotated,
keeping the picture intact.
re in the middle of its tuning

move the short from the Sine
leaving the potentiometer and
core strictly alone. If the
now torn, adjust the core in
Wave coil till it locks once

regained the picture, you will
ind that the picture will tear
ne top if the core is screwed
ut of the winding, and dis-
ompletely if it is screwed too

e waveform was present in the
eceiver with the core screwed
latter extreme, rather than
r, though it should not be
close that locking is erratic
witched from Channel to
.

EOF POT.

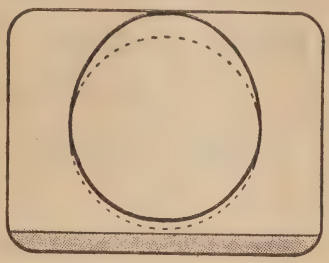
s thus selected a position for
n the Sine Wave coil, turn
nce again to the Line Hold
ter. Swing it through its full
note whether the picture
or in one extreme. If so, make
djustment to the horizontal
ore so that the behaviour of
ometer control is more near-
l, holding in the centre of its
and causing picture break-
er extreme.

scilloscope is available, it is
ry to short out the Sine Wave
ery clip the CRO to the tapping
horizontal oscillator coil and ad-
re in the Sine Wave coil till
orm is as indicated on the
dit, with the rounded portion
below the amplitude of the

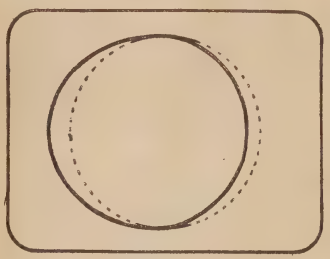
the Sine Wave coil adjusted to
give this waveform, set the core in the Horizontal Oscillator coil to give balanced operation of the Line Hold potentiometer about a central locking position.

While making these adjustments, you may have noted a vague whitish vertical line down the picture, somewhere near the centre of the screen. This indicates excess drive to the line output stage and the 20-220pF horizontal drive trimmer should be screwed in till the line just disappears.

Next operation is to adjust the picture dimensions in terms of height



If the circles in a test pattern are egg-shaped, with the peak either at the top or the bottom, further adjustment of the Height and Frame Linearity controls is called for. If the circuit is peaked at both top and bottom or is alternatively flattened at both top and bottom, the width may need to be adjusted.



Poorly adjusted horizontal linearity can produce distension on one side of the pattern or the other. See text for suggested corrective measures.

and width for linearity in both directions. To do this properly, you will have to await a circle test pattern from one or other of the stations.

Don't be dismayed if your first view of a test pattern reveals shapes which are scarcely recognisable as circles. The design provides full facilities for setting linearity and dimensions and the final result can be as good as if not better than the average commercial receiver currently available.

The vertical adjustments are best tackled first, if only because the effect of the adjustments is more obvious.

Begin by setting the centring magnet in its neutral position. It is made up from two ring magnets, clipped together and each with an extended section to form a lever. When the two levers are together, the magnets cancel and there is little or no deflecting effect on the beam.

It is desirable to have the receiver right way up on the bench to adjust the picture dimensions and position because the electron beam is affected to a degree by the earth's magnetic field.

A standard "trap" is to adjust and centre the picture very carefully with the chassis lying on its side, only to find the picture bodily displaced when the set is turned the right way up.

The two vertical deflection controls in the receiver are highly interdependent in their effect and the terms "Height" and "Linearity" are more valuable as an identification for the set builder than as a description of their individual functions. They have to be manipulated together to get the best overall effect.

The 5,000-ohm control changes the bias on the frame output valve, while the 2.5meg control varies the signal amplitude applied to its grid.

By varying the signal input and bias, different degrees of curvature are produced in the valve's dynamic output characteristic, which tend to balance out curvature of the input signal and the deflection characteristic to give a fairly linear overall result.

HEIGHT, CENTRING

Begin by setting the 2.5meg pot. at about the centre of its travel and adjust the 5,000 ohm pot. till the active picture just fills the height of the screen. It may be somewhat off centre and you can either allow for this visually or pull the two levers of the centring magnet slightly apart, one way or the other, rotating the assembly round the neck to keep the image central on the screen in the vertical plane.

The circle cannot be correct until the picture width and horizontal linearity are also adjusted but it is possible to see quite readily whether the top or bottom of the pattern is being distended or compressed.

If the top of the pattern is distended or stretched and the bottom compressed, rotate the 2.5meg pot. shaft a very small fraction of a turn in the direction which DECREASES the resistance in circuit. Readjust the 5,000 ohm pot. for correct picture height and observe the result.

Continue the process in small steps until the top begins to compress and the bottom to be distended. This indicates that the process has been carried too far and it can be reversed until the best balance is obtained between top and bottom of the pattern.

BEST COMPROMISE

Conversely, if your initial rough setting produces compression at the top and stretching at the bottom, increase the proportion of the 2.5 meg pot in circuit by small steps, readjusting the 5,000 ohm pot each time, until top and bottom of the pattern are balanced.

Correction of this nature may not be completely linear over the entire height of the screen, a point which becomes evident when viewing a test pattern containing two concentric circles.

It may thus be possible to obtain a perfect inner circle but with an outer circle which shows definite aberration. Rather than settle for such a condition, it is often better to compromise somewhat, allowing some slight distortion of the inner circle in order to minimise

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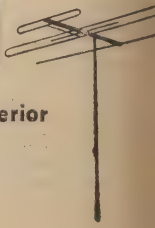

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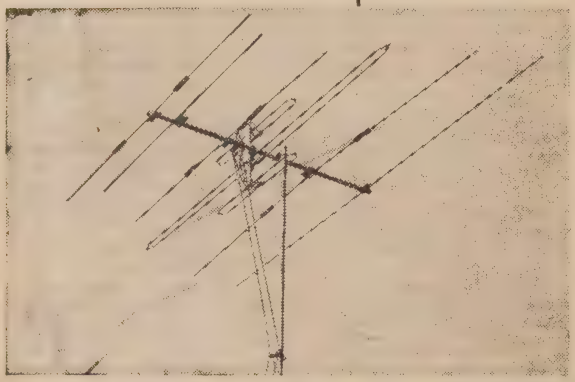

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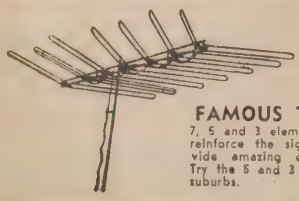

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of the outer one, particularly
op.
e frame circuits properly ad-
picture should remain lock d
of the range of the Frame
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ble that the locking position
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h a case it is quite in order
se or decrease slightly the
the resistor in series with
ntiometer, to centralise the
ange. In some cases, with
eceiver, the 1.2 meg resistor
increased to advantage to

LINEARITY

of picture width and hori-
arity rests mainly with core
in two coils in the EHT

arity coil is in series with the
to the damper diode, and
e law of the reaction scan
ft-hand side of the screen.
th coil is a double section
shunting a section of the line
nsformer and part in series
ad to the yoke. As the core
out of the series coil and into
coil, it reduces the inductive
in series with the yoke and in-
transformer shunt impedance,
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a pattern generator, horizon-
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it can be judged with rather
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tc wide or too narrow, or
articular region of the circle
ed or distended in the hori-

G AT CENTRE?

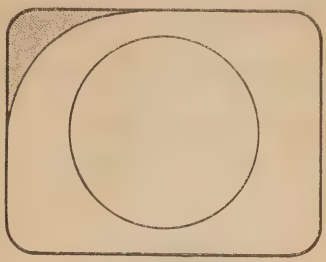
vi probably find that screwing
ar core well out introduces
ar the centre of the pattern.
peakiness which might well
ny tendency for the top or
the pattern to appear dis-
because of imperfect frame

re is a suggestion of centre-
ression, therefore, try screw-
rarity core in until the effect
s.

he core in the width coil
compresses the pattern both
n general, the greatest effect
eft-hand side of the screen.
of the width coil is too far
a tendency for the pattern
ssed unduly on the left-hand
citating adjustment of the
gnets to keep it central on

Compression on the left, therefore, with the need for substantial centring action, is a likely indication that the core of the width coil should be screwed further in, width being readjusted by the linearity core, as far as is possible, without causing undue non-linear effects elsewhere.

At the same time, every effort should be made to produce a circle pattern which is, in fact, a circle. Too much

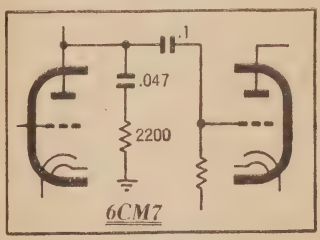


"Neck shadow" effect, blacking out one corner or the other of the screen, may be caused by incorrect .etting of the ion trap or maladjustment of the electrical circuit making it necessary to use extreme correction by the centring magnets.

width will produce an oval shape, like a football. Too little width, or excessive height, will produce a pear shape or football-on-end figure, and the picture area may not occupy the full width of the screen.

You will find that there is some discrepancy between test patterns radiated by different channels at different times, indicating a possible variation in scanning adjustment at the transmitter and/or some reaction of the receiver itself to different patterns and signal strengths.

Whatever the cause, do not be perturbed by such variation. Try to strike a set of adjustments which is reasonably average allowing the picture area



In some cases, interlace can be improved by reducing in value or even eliminating the 2,200 ohm resistor in the frame oscillator plate circuit.

to run over the edge of the screen by a small amount all round, enough to hide small variations.

You will find that the Line Hold potentiometer moves the picture bodily sideways between the two tearaway extremes. Leave it set in the position where it holds positively when switched from channel to channel and where there is no suggestion of flutter or bend at the top of the picture.

With the Line Hold thus set, adjust the centring magnet so that the picture fills the screen area with a slight overlap all round.

There is little that can be said to explain the adjustment of the centring magnet in so many words. The magnet has least effect when the two arms are together and greatest when they are directly opposite.

The procedure is to open the arms a little and rotate the magnet around the neck until it moves the picture in the desired direction. If the movement is too great, bring the arms closer together; if not enough, spread them further apart.

It matters little in which direction they are opened. If their positions are reversed, correct picture centring is simply obtained with the magnet on the opposite side of the neck.

In our prototype receiver and in most other similar receivers which we have handled, correct centring has been obtained with the centring magnet levers fairly close together, indicating the need for only small correction.

MOVES PICTURE

It is interesting to note in passing that the 15pF capacitor in parallel with the 0.15 meg resistor in the line oscillator feedback circuit has a phasing effect which moves the picture sideways and alleviates horizontal centring problems. The capacitor was not shown in the original 17-inch receiver, and could be added to advantage in some cases.

Assuming the use of this capacitor, the need for extreme centring action might indicate severe non-linearity or some other electrical malfunctioning in the deflection circuitry.

Off-centre pictures can also be caused by misalignment in the picture tube itself, by DC through a section of the yoke, by residual magnetism in the yoke or adjacent metalwork, or by the influence of an external magnetic field, as from a speaker or filter choke.

Apart from being an indication of possible malfunctioning of the circuit, excessive correction may be accompanied by the rather disconcerting "neck shadow" effect. As the picture is brought toward centre, one corner is suddenly seen to disappear, due to electrons striking the tube neck en route to the screen.

In such a case, setting of the centring magnet becomes very critical, the shadow also being affected to a degree by the position of the ion trap magnet.

WRONG MAGNET?

Over and above the factors already mentioned, tube manufacturers warn that neck shadow effects can result from the use of an ion trap not designed for the particular tube, likewise an unsuitable yoke assembly. A yoke which is too long or which will not fit snugly against the glass funnel may begin to deflect the beam too far inside the narrow neck, with the inevitable result mentioned.

While the adjustment of focus, height, width, linearity and centring have, of necessity, been explained as individual operations, you will find in practice that the tendency is to carry out the initial adjustments as described, then to go over them as necessary, touching up first this and then that.

Having thus adjusted the picture, it can be checked for interlace. If you haven't made this check before, it requires a little co-operation between you and your eyes.

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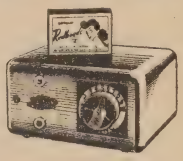

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HOMECRAFT'S FAST DESPATCH SERVICE

canning lines for alternate fields actually fall on alternate areas screen, each individual area be minated 25 times per second. makes it possible to observe effect with normal interlace ur finger slowly up the screen or lown the screen, looking at your nd the lines beyond, rather than etails of the picture. The lines ppear to crawl up or down the according to which way your eyes are moving.

having seen the effect, so that w what to look for, the strob- be observed immediately on any by just looking.

nay find that the interlace effect ied by different settings of the fold control. Ideally this should nen but it is a fairly common nance in practical receivers. Pro- terlace is evident and normal at an extreme or critical settings control, slight inter-dependence wo is scarcely worth pursuing.

TERLACE?

re is no sign of this strobing id if the lines appear to be id stationary, as if ruled on the he chances are that the alter- ids are not interlacing and re- measures are called for, as out- er.

jige the accuracy of the inter- another visual trick is required. id concentrate the gaze on a f gment of the pattern or picture ch the line structure.

th average receiver you will see pairs of lines, each tending to id jitter slightly, due mainly to 2 frame frequency. With perfect e the lines are very thin and y spaced, with fine black non- ed regions between.

th average case some slight in- ts often evident, the lines tend- air slightly, leaving the black between of slightly different e pairing may also show some rio residual hum on the HT line. vied that adjacent lines do not y merge, however, the visual slightly imperfect interlace are rtant at ordinary viewing dis

plete lack of interlace visibly es picture quality at normal distances and assuming normal uity. Some effort is therefore o correct a non-interlace con-

OF INTERLACE

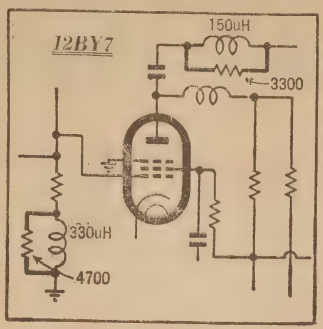
essed in other articles, the zard to interlace in a receiver tion of energy from the receiver's ir output circuit into the grid f me oscillator valve.

erposed on the frame integration th line retrace pulses can cause an oscillator to trigger each time e nd of a line, instead of half ch each alternate line, as re- ir accurate interlace.

th effect is sufficiently serious, triggering may occur more or less don any one of the retrace wich coincide with the frame in- on curve, causing the picture to vertically over a distance equal o r three lines.

ce a fair mount of stray line may be present around the s a whole, it can be picked up ng leads or bulky components or

badly placed components beneath the chassis, to do either with the synch. separator or the frame oscillator. The original layout was carefully planned to guard against this possibility and should be followed unless you are able to plan



Any suspicion of overshoot or ringing can be removed from the video detector and amplifier by adding two damping resistors as shown. Trouble of this nature, still evident, would indicate the need for alignment, with particular attention to the higher frequency sideband zone.

variations therefrom with equal care.

Above the chassis, it is important not to allow the yoke leads to trail around the frame oscillator valve or transformer. The possibility is largely eliminated in our latest receiver but needs to be watched in the earlier versions, where floating leads were used.

ANOTHER HAZARD!

Investigation during the last couple of weeks has revealed yet another surprising hazard to interlace. Due to inherent limitations in the yoke, a certain amount of line energy is apparently coupled into the horizontal deflection coils and thence fed back via the horizontal output transformer to the 6CM7 output valve.

Being a triode, this exhibits enough grid-plate capacitance to transfer line energy to its grid, whence it is coupled to the oscillator plate. Line impulses on the plate can trigger the oscillator very effectively, being sufficient in one case we examined to cancel the interlace completely and even produce occasional frame jitter.

A simple method of dealing with the problem is to reduce the value of the 2,200 ohm resistor in series with the .047mfd capacitor from the frame oscillator plate to earth.

The resistor is included primarily to produce a spike at the start of the capacitor charge curve and assist in obtaining the best possible frame linearity. In practice, it does not appear to be a very vital component and its elimination or reduction allows the capacitor to act as a bypass for the unwanted high frequency energy.

In our own prototype receiver which, incidentally, has always exhibited good interlace characteristics, the resistor could readily be reduced to 1,000 ohms, while still maintaining plenty of "spike."

In two other cases, where interlace had been a problem, complete elimination of the resistor produced good interlace without upsetting frame linearity.

It may, however, be unwise to recommend complete elimination of the resistor as anything more than a step which can be taken in cases where there are no resulting complications. There is a chance that elimination of the resistor could prejudice linearity in some receivers while tending also, we understand, to increase the peak grid current of the oscillator valve to undesirable proportions.

RINGING PROBLEM

Another possible problem, which can compromise ultimate picture quality, has to do with two closely allied effects, namely "overshoot" and "ringing."

When the picture information changes abruptly from, say, black to grey, the signal circuits may exaggerate the effect and show it as a change from black to white, which then tapers into the intended grey tone. As a result, dark areas or objects on the screen gain a white halo around the right hand edge.

This so-called "overshoot" effect can occur also on abrupt changes from white to grey, such that light areas or objects on the screen acquire a black border around the right-hand edge.

If the electrical conditions in the circuit are sufficiently bad, the simple overshoot condition may extend into one or more complete ringing cycles which produce a contrasting border, as already explained, followed by another complete outline, a fraction of an inch to the right, then perhaps a second and fainter contrasting border.

In such cases, the visual effect can be quite grotesque, particularly when the edge of a character's face, or his features are repeated with just enough emphasis to look like facial wrinkles.

The whole visual effect is rather like that produced by one or more "ghost" patterns, spaced only a small distance from the basic image. The two can be points of difference:

(1) Ghost patterns repeat the basic image without necessarily causing an exconfused very easily but there are likely aggeration or reversal of the right-hand edge tones, and

(2) Ghost patterns usually differ from Channel to Channel. Ringing is more consistent unless it happens to be caused by differing alignment aberrations from Channel to Channel.

"A COURSE IN TELEVISION"—

Our course in television has not been terminated, despite its omission from the last two or three issues. It has simply been held over, because of the space allotted to the present constructional television articles and the need to cater for readers interested in other fields.

IT'S HAPPENED

Tests recently conducted by a field operator have proven without doubt that the "Q Plus" kitset will more than hold its own against most commercial receivers for fringe area reception.

Indeed only one commercial receiver using 23 Valves (4 extra valves) was actually equal to it.

Tests in Cowes, Victoria, showed that the receiver operated even with a short length of ribbon shorted at the ends!

Circuit function and valve types

Power Supply (5AS4)

Primary taps for 200, 220 and 230 v. operation, desired tap selected by special plug and socket, mounted on power supply chassis, full wave rectification with capacitative input filter, giving low ripple content. A 300 mA fuse is incorporated. Mains transformer has copper shield for minimum external field.

Tuner (6BQ7A, 6U8)

Q Plus type VTT/1 10 channel turret tuner featuring low noise "Cascode," R.F. amplifier and high-mu mixer oscillator. Low impedance output to I.F. channel. Special moulded coil formers threaded throughout their entire length prevent cores from coming loose. Special "alkyd" low loss high stability plastic used on all coil biscuits and mouldings. Oscillator is compensated for frequency drift due to variations in temperatures. This unit comes fully tested and pre-aligned.

Video and Sound I.F. Channel (4-6CB6, 2-6AL5, 1-6AU6)

The ever popular Mark III I.F. strip, four stages of video amplification using bifilar and an over-coupled stage, low impedance input to match VTT/1 tuner. Video detector, with R.F. filter and video detector load, intercarrier taken from video detector. Sound amplifier/limiter stage and ratio detector, fully tested and aligned.

Audio Amplifier and Output (6AV6, 6AQ5)

A triode voltage amplifier with beam tetrode power output. Negative feedback is applied to the 6AQ5. The required F.M. de-emphasis is obtained by a simple R/C network at the input to the volume control. Frequency response 90 C/s—5Kc/s at—6db.

Video Amplifier (12BY7)

A high gain pentode using a combination of series and shunt peaking. Video detector is directly coupled to video amplifier grid. Output is capacitatively coupled to picture tube cathode. The gain (contrast) is controlled by a cathode potentiometer. Frequency response up to 4 Mc/s at -6db., and greater than -40 db., at 5.5 Mc/s.

Sync Separator, Sync Phase Inverter (12AU7)

Sync pulses are obtained from the output of the video amplifier and applied to the sync clipper which removes most of the video content, and provides a substantial degree of noise immunity. The sync phase inverter further separates the sync pulses from the video, and also reverses the phase suitable for triggering the line and frame oscillators.

Frame Oscillator and Frame Output (6CM7)

A frame blocking oscillator is used. The frame output stage drives the deflection using an auto-transformer to match the output to the yoke impedance.

Line A.F. Line Blocking Oscillator or 6SN7GTA

The line A.F.C. is a D.C. control valve to correct the line blocking oscillator which used a "sine wave" stabilising coil. Small changes in sync control are obtainable by a pot. control on the D.C. control valve. Once aligned correctly, this circuit will remain in sync. over long periods, with varying signal strength and mains variation.

Line Output, E.H.T. Supply (6DQ6A, 1B-3GT, 6AX4-GT)

The line output/E.H.T. transformer (Q Plus VHOPT/1) (auto-transformer type) and the E.H.T. rectifier are shielded in a metal case and cover, supplies 15 KV picture tube ultor on load. Provision is made to alter this section for higher ultor voltage and drive suitable for a 90 deg 21in picture tube. Picture tube (17AVP4A) 90 deg magnetic deflection, electrostatic focus.

A.G.C.

"Simple" type A.G.C. voltage is developed by separate rectifier has an A.G.C. clamp.

Chassis

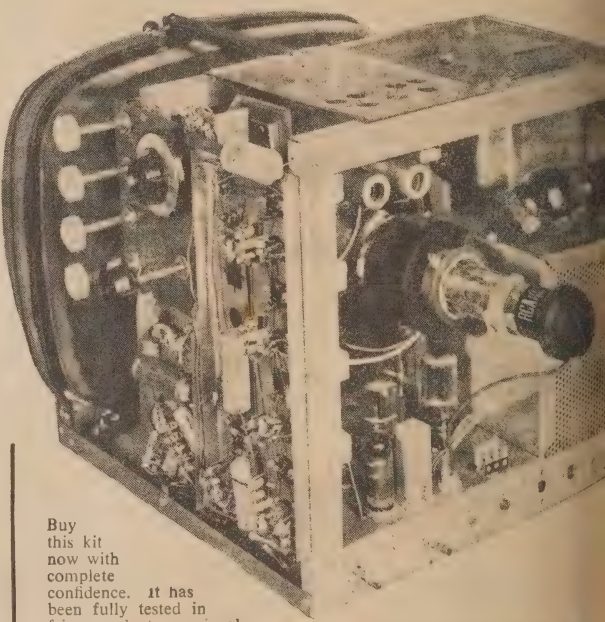
The main chassis comes pre-assembled, ready to take the power supply, line output/E.H.T. case, tuner, video and sound I.F. channel, frame oscillator and output sub-chassis. The picture tube mounting, strap etc. are screwed to the main chassis, making it one complete unit.

Controls

Channel selector and fine tuning are a dual concentric knob, volume off-on, brightness, contrast, frame hold, line hold, controls are grouped together and fitted with smaller knobs. Frame height, frame linearity, line drive, line oscillator, line sine wave, controls are mounted on the rear of the main chassis. All these controls can be adjusted without removing the back of the cabinet.

General

The speaker (5in) is mounted on the left hand side of the cabinet and mounted onto the cabinet. 9ft of 3-core P.V.C. sheathed power flex extends from the rear of the cabinet.



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ig problems, as such, are al-
rely a matter of location, aerial
siting and must be attacked
grounds. Overshoot and ring-
ver, occur within the receiver
for internal amendment and
t.
ht be expected, overshoot and
ffects in a receiver are most
n studio or high quality film
where sharply defined edges
uce sudden transients in the
ormation. With low definition
or with the receiver deliberate-
ed to eliminate the high fre-
the effects may not be evident,
ay operate merely to sharpen
ise hazy edges.

ATE OVERSHOOT

t of fact, some designers allow
mount of overshoot in the de-
ive sharper looking pictures.
for a good deal of discretion,
because a small amount of de-
vershoot can add to an accid-
unt occurring elsewhere, to
n undesirable total.
hoot effects, or their visual
nt, can readily occur as the
of incorrect alignment, as
highly erratic overall re-
curve or one with exagger-
ponse to the higher modu-
requencies.
ively, they may be produced
eo detector and amplifier sys-
eason of excessive high fre-
ost or maladjusted boosting

in the video circuits is not
a problem of any magnitude
T and H receiver, the design
for barely perceptible over-
the Contrast Control in the
position, where the greatest
igh frequency boost is ob-
owever, variations in layout
ing choke values could con-
roduce some variation in the
characteristic.
eck on the position, we tested
l receiver both for overshoot,
ply defined vertical bar pat-
for frequency response, using
nerator and a crystal VTVM
negligible input capacitance.

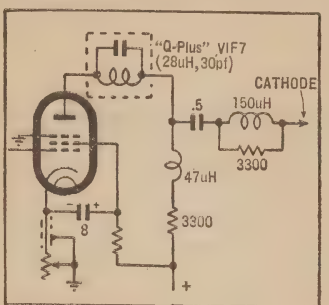
TIAL TESTS

bservation, a 3,300 ohm resistor
h 150uH peaking choke served
me the anticipated small over-
m the video amplifier itself,
educing the final video re-
ow the figure suggested by the
"Radiotronics" for the 12BY7.
nt was necessary across the
e.
osition in respect to the 330uH
ing choke is more difficult to
ause the variable and rather
ble impedance of the diode
eding it cannot be simulated
truments with any certainty.
it completely conclusive to
lts on a signal fed through
annel, because the character-
he IF channel itself then in-

wn for possible errors, however,
tsindicated that a 4,700 ohm
parallel with the 330uH diode
oke would eliminate any dan-
ring in this circuit.
o shunt resistors were not
the basic circuit, for the reason
ey id not appear to be necessary
ard fitment. However, if ring-

ing troubles are evident, one or both resistors can be added as an initial precaution.

With both resistors in position, the possibility of overshoot and ringing in the video detector and amplifier can virtually be eliminated. Any trouble of this nature which may then be evident can fairly be attributed to the alignment of tuner and IF strip, the implications being obvious.



Modified as shown above, the video amplifier will give improved rejection of any 5.5Mc component, along with extremel, good frequency response and negligible ringing.

Over and above the foregoing problems, the entertainment value of television pictures can be compromised considerably by various interfering patterns, which can introduce wavering criss-cross lines across the screen.

The source of many of these interference patterns is a study in itself, their origin being often quite obscure. The most usual cause is a heterodyne beat between some harmonic of the picture or sound IF and one of the incoming signals or one of its harmonics to produce an ultimate spurious resultant within the video pass band of the receiver.

Squegging effects in the oscillator or interference from another nearby receiver can also produce these unwanted patterns.

While it is not possible to say much on the subject here, it may be helpful to point out that the trouble is often aggravated by operating the set with excessive input signal, such that one or more IF stages operate in a virtual overload condition. Interference patterns often disappear therefore with the inclusion of an aerial attenuator pad.

POOR AERIAL?

Conversely, trouble can sometimes follow the use of an inefficient, indoor aerial or one with notably unbalanced feeders, such that it is unduly receptive to locally generated signal components.

Over and above these "accidental" effects interference with the picture may readily occurr from the 5.5 Mc beat between the picture and sound IF components. This last is produced deliberately in the video detector and amplified in a separate IF channel, to recover the sound information.

However it must be prevented from reaching the picture tube with any significant amplitude, otherwise it appears as a very fine modulation along the scanning lines, having a dimension comparable with the distance between the lines themselves.

It is most likely to be seen when the receiver is tuned close to the sound bars, tending to disappear as the tuning is turned away from them.

Precautions are taken in the design of television receivers to prevent this 5.5Mc interference from occurring. These include shaping of the response curve so that on the sound plateau, it has about 5 per cent of the response amplitude to other frequencies. One or more trap circuits are usually included in the detector or video amplifier, while the video response may also be allowed to taper off, due to natural losses, in the 5Mc region.

CATHODE TRAP

To date R,T and H receivers have used a single cathode trap, tuned to 5.5Mc. This was suggested in original application date for the 12BY7, a point claimed in its favour being that it was less prone to produce ringing than traps elsewhere in the circuit.

By and large, the arrangements has worked out well enough but we have come across some instances where the 5.5Mc content in the picture has been higher than we would have liked.

In some cases alignment has been primarily to blame; in others, the nature of the IF strip has accounted for a difference while, in all cases, operation with the Contrast Control fully off renders the trap less effffective than otherwise.

During the last few days, we have had the opportunity of checking operation of the video amplifier with a 5.5Mc trap in the video plate circuit, taking particular note of its influence on frequency response and the tendency to ringing.

Numerous figures were taken with peaking chokes in and out of circuit and variously shunted and with the Contrast Control in different positions.

To cut a long story short, we are now in a position to recommend the circuit arrangement as shown, with a standard Q-plus VIF7 sound trap coil wired directly in series with the plate lead of the 12BY7. The cathode trap can be eliminated, as being no longer necessary.

STANDARD COMPONENT

It transpires that the VIF7 coil is suitable for use in the plate circuit, inspection showing that it is tuned by a 30pf capacitor. It must therefore have a coil inductance of 28 (approx.) microhenries. The original low impedance trap designed for the cathode circuit is not suitable for the new position.

Because the trap tends to sustain the response just short of its attenuating frequency, the response is actually better than without the trap in circuit, yet the attenuation to 5.5Mc is always well over 30db, irrespective of Contrast Control setting.

Measured response showed 0db for 0.5Mc. a rise of just over 2db at 1.5Mc, less than 3db down at 4Mc, 1.2db down at 5Mc and more than 30db down at 5.5Mc.

In a typical receiver which had previously given some trouble with 5.5Mc interference, this order of rejection from a plate trap removed all trace of it.

Physically, installation of the plate trap is not a very difficult job. By slotting the mounting holes, the VIF7

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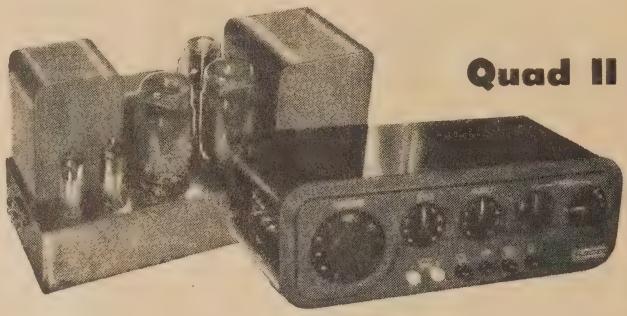


Quad II Amplifier

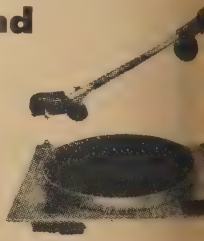
The acoustical Quad II amplif and Q.C.II control unit are ge rally recognised as giving closest approach to the origi sound. You should see also Acoustical F.M. tuner which g with the Quad II. U.R.D. a stock many other makes of amp fiers including the excellent Rog R.D. Junior.

Ferrograph Tape Recorder

A tape recorder with the qualities of the Ferrograph should be looked upon as a long term investment. The Series 3A illustrated here is a high-fidelity instrument and has the following features: Single function switch, bass and treble controls, frequency response at 15" per sec.: 40-15,000 c/s.

Connoisseur Pick-up and Transcription Motor

These two Connoisseur units provide fine equipment for reproducing sound on disc. Pick-up downward pressure: 5 grams. Frequency range: 20 c/s to 20 Kc/s. Variable 3 speed motor with 4% variation by mechanical means.



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particularly
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n be mounted in the position
ly occupied by the cathode trap,
ie lugs closest to the centre of
ssis.

suggest that the 12BY7 socket
ntated, if need be by drilling new
so that the plate pin is as close
ible to the trap coil, the grid
ards the rear of the chassis still
andy to the IF strip.

a short length of wire from the
in to the farthest lug on the
oil, keeping it away from the
The 47uH peaking choke can
from the remaining lug to the
supporting the 3,300 ohm plate
sistor. Finally, the 0.47mfd coup-
acitor can bridge from the appro-
ug on the trap coil to the nor-
point, where it connects to the
choke.

BE SHUNTED

that this last should be shunted
resistor, when a plate trap is
No shunting is required across
uH choke and, in fact, our
d figures show that it could be
altogether without making any
ble difference to the picture, as
However, since it will be on
t may as well be retained.

nation of the cathode trap
sit possible to run the shielded
lead directly from the potentio-
m the front lip of the chassis
cathode pin of the 12BY7. As
ted earlier, the lead must be in
pacitance coax type cable and
adjacent to the 12BY7 socket.
response figures quoted earlier
the use of a direct cathode lead
type and, for the sake of the
the total cable and socket capa-
cathode-to-earth was measured

aring the subject, observations on
different receivers during the
w weeks have enabled us to
clearer picture of the operation
le AGC circuits and their be-
in different circumstances.

entioned in the first article on
sent receiver, our earlier sets
simple AGC system, with the
voltage derived directly from the
ode load. This proved adequate
instances, though we did have
reports of receivers exhibiting
verload effects, notably picture
and rolling.

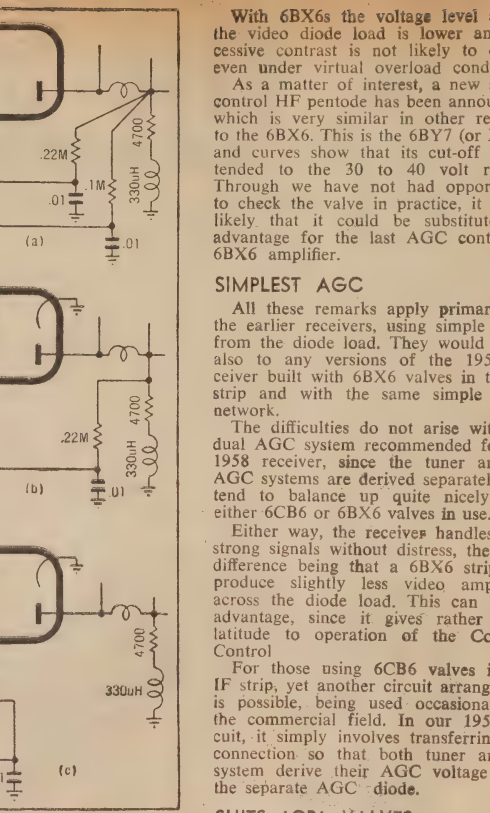
CONSISTENT

iswas puzzling because the degree
verload was not consistent with our
servations and was not accom-
by high degrees of picture con-
hich would have indicated high
ideo volts across the detector

vuld now appear that most of
mplaints have arisen from cases
BX6 valves have been used in
IF strip rather than the 6CB6s
ay intended.

ist glance, the two types appear
very similar electrically and it
ical and necessary to use one
pplies of the other were res-
Both were used in prefabricated
d both type numbers appeared
ircuit diagrams.

inspires, however, that differ-
hods of presenting the applic-
ata clouds the fact that the 6CB6
id base or cut-off characteristic
0 per cent greater than the



The original AGC circuit (a) was most likely to give overload troubles with 6BX6 valves in the IF amplifier, for reasons explained in the text. The suggested circuit (b) is satisfactory for both types. Modification (c) works well with 6CB6 valves in the IF amplifier but does not suit 6BX6's.

6BX6. While the difference is just one of design, it is a significant one in terms of AGC distribution and operation.

With the original simple AGC circuitry, it means that the 6CB6 valves develop a larger video and DC voltage across the diode load for a given amount of gain reduction on strong input signals. This larger voltage is able to limit the tuner gain reasonably well.

With 6BX6 valves, the order of voltage developed across the diode load is markedly lower. Less control is available for the tuner, which means that the IF strip has to handle higher input with valves which are already rather more prone to signal clipping by reason of their sharper cut-off characteristic; hence the difficulties mentioned.

Over and above the matter of overload, the diffference in control characteristic affects also the contrast levels in the video amplifier system.

With 6CB6s the video and DC level across the diode load tends to equalise in the 4 to 5 volt region and, with very strong signals, can result in pictures having high contrast even with the Contrast Control fully off.

With 6BX6s the voltage level across the video diode load is lower and excessive contrast is not likely to occur, even under virtual overload conditions.

As a matter of interest, a new super-control HF pentode has been announced, which is very similar in other respects to the 6BX6. This is the 6BY7 (or EF85) and curves show that its cut-off is extended to the 30 to 40 volt region. Through we have not had opportunity to check the valve in practice, it seems likely that it could be substituted to advantage for the last AGC controlled 6BX6 amplifier.

SIMPLEST AGC

All these remarks apply primarily to the earlier receivers, using simple AGC from the diode load. They would apply also to any versions of the 1958 receiver built with 6BX6 valves in the IF strip and with the same simple AGC network.

The difficulties do not arise with the dual AGC system recommended for the 1958 receiver, since the tuner and IF AGC systems are derived separately and tend to balance up quite nicely with either 6CB6 or 6BX6 valves in use.

Either way, the receiver handles very strong signals without distress, the chief difference being that a 6BX6 strip will produce slightly less video amplitude across the diode load. This can be an advantage, since it gives rather more latitude to operation of the Contrast Control

For those using 6CB6 valves in the IF strip, yet another circuit arrangement is possible, being used occasionally in the commercial field. In our 1958 circuit, it simply involves transferring one connection so that both tuner and IF system derive their AGC voltage from the separate AGC diode.

SUITS 6CB6 VALVES

Tests indicate that the 6CB6 valves will operate quite readily under these conditions with very strong input signals, the advantage being that the video detector output voltage is reduced well below what it would otherwise be. This ensures, in turn, that there will always be plenty of latitude in the operation of the Contrast Control.

The particular arrangement is not recommended with 6BX6 valves in the IF strip, their sharper cut-off characteristics, as already outlined, making them less suitable for use in a common AGC system, particularly one delivering an augmented control voltage.

As a matter of interest, brief observations were made on two other types of IF strip, which happened to be on hand. One of these, reviewed elsewhere in the issue, uses three only 6BX6s in the video IF chain, two of them controlled by an in-built AGC line from the video diode load.

Here, again, the limitations of this most elementary system were evident, applied to 6BX6s. the receiver tending to overload on strong input signals. This would have to be countered by the use of a pad, or a less ambitious aerial, or by modifying the strip to provide more extensive control for the tuner.

The other IF strip was a typical 6AC7 home-constructed unit, originally intended for our 5in receiver but used also, by way of illustration, in our earlier 21in model.

The general behaviour of this strip

(Continued on Page 121)

FOR THE BEGINNER

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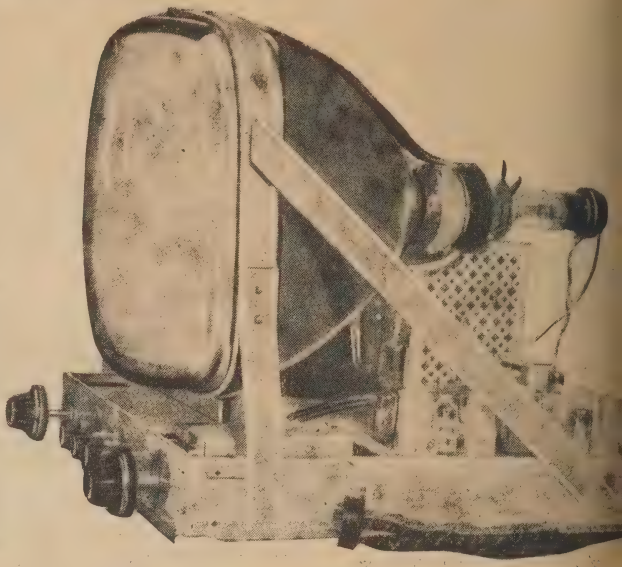

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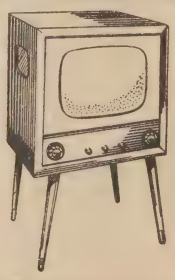

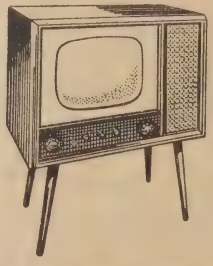

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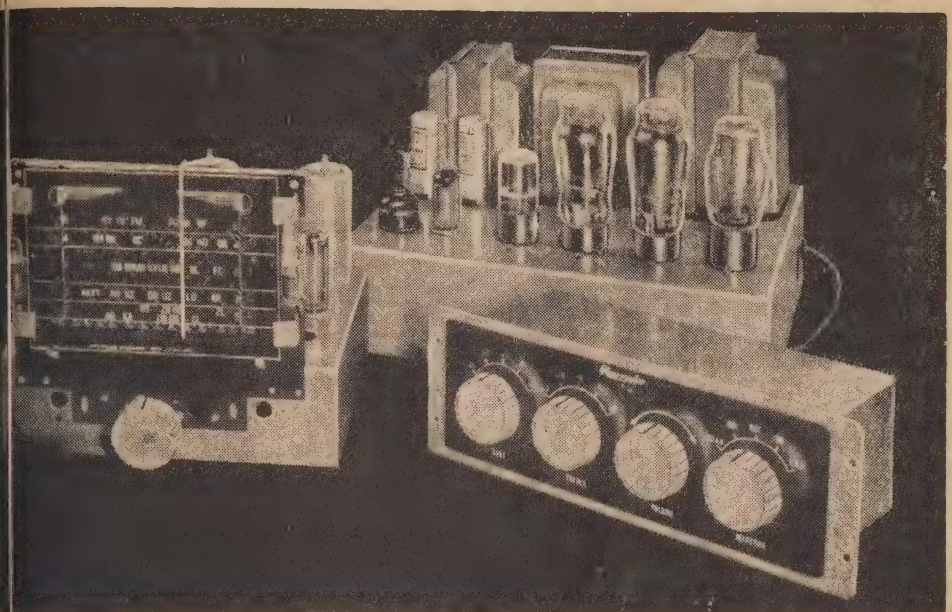

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Here's your answer, Tom!

This month Tom's initial query deals with a subject to which most TV-minded experimen must have given thought at one time or another. We feel certain that the explanation out below will be of more than passing interest to experimenters and technicians alike.

What is "screen burn" and how is it caused?

It so happened, Tom, that after the receipt of your query we came across some facts about screen burn in a recent Mullard publication. Having read through it, we felt that the best explanation we could give you would be simply to reprint the complete article, so that the following paragraphs are credited to the Mullard company.

The most destructive form of screen burn is caused by bombardment of the screen material by heavy negative gas ions.

These are produced in the neighbourhood of the cathode where the velocity of the electrons is low and where it is therefore more likely that collision between a gas molecule and an electron will result in the electron attaching itself to the molecule, forming a negative gas ion, than that it will expel an electron from the molecule, forming a positive ion.

These negative ions can be accelerated by the potentials on the electron gun, and if allowed to reach the luminescent screen may strike it with sufficient momentum to damage the luminescent properties of the screen.

Negative ions can be prevented from reaching the screen by means of an ion trap. The form of trap adopted in Mullard tubes is shown in the accompanying illustration.

The axis of the gun is bent in such a way that the combined stream of electrons and negative ions is at first directed towards the wall of the final anode. A small magnet fitted on the neck of the tube provides a lateral field which deflects the electrons to an axial path, but is of insufficient strength to deflect the more massive negative ions, which ultimately reach the second anode.

A secondary cause of screen burn is bombardment of the screen by heavy positive ions, produced as the result of collisions between swiftly moving electrons and gas molecules—a certain number of which inevitably remain in the tube, no matter how well it has been pumped.

These collisions result in the expulsion of electrons from the gas molecules which are thus left positively charged. Under specified working conditions, however, risk of damage by positive ion burn is insignificant.

There is a third form of screen burn, due to bombardment not by gas ions, but by the electron beam itself. It can occur through the existence of a stationary electron beam during the period immediately after switching off and before the discharge of the E.H.T. capacitance.

Operating conditions which avoid this risk are specified and television receiver manufacturers take precautions to ensure that any such spot is of insufficient intensity to cause screen damage.

A suitable circuit arrangement for tube protection is given in the basic diagram

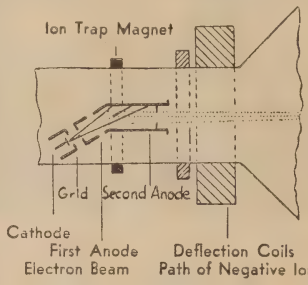


Diagram of a typical TV tube showing ion trap.

below, which shows a typical video stage driving a picture tube together with the associated brightness control.

On switching off, the H.T. voltage applied to the video stage, and hence the cathode potential of the picture tube decays very rapidly, but owing to the time constant of C1, R2 the potential tube grid decays at a slower r maintains beam current at a su high value to discharge the E.H. citance before the scanning vol creases.

At some instant during this pe voltage between grid and assumes a value at which grid flows. This current is limited resistor R1 so as to prevent the cathode potential exceeding t scribed maximum value.

★ ★ ★

What is loudspeaker respons how is it measured?

Loudspeaker response is the ship between the loudness of th torted sounds produced by th speaker and the value of the e signals producing them. The of the loudspeaker may be co level if the sounds it produces ha loudness for constant values o signal.

Loudspeaker response is meas feeding into it a pure tone prod an audio generator having varia quency and constant output thr the whole of the range over wh desired to measure the speaker r

The power level is adjusted overloading of the speaker is and a microphone, the frequenc acteristics of which are known, i a suitable distance from the spea along the axis of the cone.

The microphone output is t into an amplifier having a know response and this, in turn, is conn a measuring instrument such as loscope or valve-voltmeter.

To avoid sound reflections ar irregularities of room acoustics, is made in the open air or in a acoustically deadened chamber.

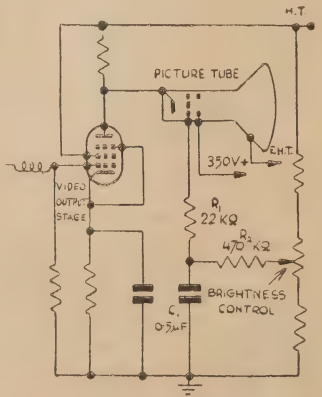
Readings are taken at regul through the range and the results on a graph. The steps are fair together so as to show up shar nances in the range.

★ ★ ★

I am puzzled by the terms " amplification" and "linear ampl Could you please explain?

Linear amplification, Tom, is t mal, ideal process of amplicatio by the output of an amplifier is s though enlarged, copy of the inp

To be more precise, the ampl the output is greater than the inp fixed ratio, measured at any fr within the intended range of the a



Connections for the TV tube discussed on this page.

is determined by the gain of
ier.
ph of the input against output
the resultant curve will be a
ne, hence the name linear. An
ulfilling the above requirements
ly referred to as a linear am-

★ ★ ★

**ne Ionosphere any connection
e term ionization and, if so,
it?**

terms are most certainly con-
m, since one is derived from

on is the name given to the
ien some of the constituent
become detached from the
gas and become free to move

Ionosphere is the name given to
ayers of the earth's atmosphere
at extremely low pressures
ratures and subjected to intense
ent by certain electrical com-
the sun's energy.
on is due partly to direct
mbardment and partly due to
and probably cosmic ray
Since ionized gas becomes
partial electrical conduction,
layers of the atmosphere have
acteristic—hence the name
e."
is of the greatest interest to
engineer. The Ionosphere
n about 20 to 200 miles above
surface and consists of three
rs varying in height. The
the two upper layers varies
itude of the sun, being greatest
y and least at night. The
also affected by seasonal
nd the solar cycle, while
ensity occurs with maximum
tivity.
mi-conducting layers are each
reflecting or bending radio
ertain frequencies. Reflection,
or both may take place and
the angle of incidence, the
in use and the density of the
ayer. Generally, the higher
ncy the greater will be the
power of the wave.
engineers put the reflecting
f the Ionosphere to good use
g the times and frequencies
sts to redirect these boadcasts
on they are intended to cover.

★ ★ ★

d is stray capacitance?

pacitance is unintentional and
wanted capacitance between
f a circuit and another. Stray
is of some importance in
n and due consideration must
it. In tuned circuits stray
adds to the intending tuning
thereby altering the minimum
m capacitance ratio.
mplifiers the phenomenon can
e osses by acting as a bypass
e grids and plates to chassis,
the signal being diverted to
stad of passing through subse-
tifier circuits.
nce between switch contacts,
., etc., will cause unwanted
sfer and can result in positive
and oscillation.
mpedance audio circuits stray
n introduces a high frequency
senting a low impedance path

ts of stray capacitance may be
eby a suitable spacing of the components and wiring and, in the case of unwanted energy transfer, by metallic shielding.

I have noticed that a number of valves have a coating on their glass envelopes. A check with an ohmmeter revealed that this coating is not an insulation. Am I right in assuming that it is a form of shielding?

The coating on the glass envelope of certain valves is conductive as you have observed, and acts as an electrostatic shield. This shield is as effective as an external can type and is more convenient in application.

However, it has been found that the metallic coating is inclined to peel and chip over a period of time and the tendency with modern valve construction is to provide an internal shield.

External and internal shields are usually connected to a base pin if there is one to spare, otherwise they are connected to the cathode. Valves with internal shields do not normally require an external shield though, in special cases, an external shield may be desirable for complete stability.

★ ★ ★

I have heard of "ghosts" in TV sets and have a fairly clear picture of the cause and effect, but I have recently heard reference to "spooks" in TV sets. Are these the same thing with a different name or are they something quite different?

We're not quite sure of the view taken by the Psychic Research Society, Tom, but we can assure you that, as far as TV sets are concerned, the two effects are quite different.

"Ghosts" are essentially a problem external to the receiver; one of locality rather than receiver design, with aerial design, placement and orientation as the main line of defence against it.

"Spooks," on the other hand, are produced within the set and more particularly in the damper diode circuit associated with the EHT cage. Line frequency signals in this part of the circuit are rich in harmonics, as well as having considerable power. As a result, they can radiate these harmonics in sufficient strength to be picked up by the RF or IF stages and cause interference patterns in the picture.

The interference often takes the form of a narrow vertical line very close to the left hand side of the picture. It is normally dark with ragged edges, except where the signal is fairly strong, in which case it tends to break up into a crawling pattern. Vague, zig-zag, whitish lines that move towards the centre of the picture are also referred to on occasions as "spooks" and relate to much the same cause.

In some cases a "spooks" line may not be visible due to its falling outside the picture mask or even within the horizontal blanking period. However, it can still cause trouble by interfering with the synch. circuits.

To keep this kind of "spook" under control it is essential that the damper diode, and which is normally part of the EHT cage, be adequately shielded. In addition, a small choke, known as a "spook suppressor," is connected in series with the damper diode.

All of which brings to mind the story about a ghost (the fair dinkum variety) who bought himself a TV set. He returned it the following day; complained he got people on it! So long, Tom.

TV

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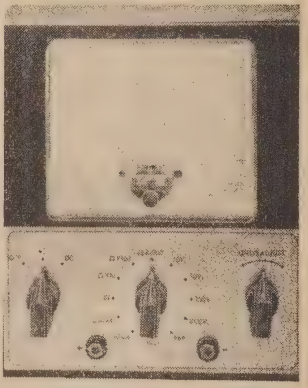

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SF79	9½	6½	7½	19 6
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The 9ft 7 Mc aerial installed rear bumper bar. It is little m trusive than rear bumper aerial used for broadcast band rec

Aerials for 7Mc Amateur Mob

One phase of amateur radio activity which is becoming increasingly popular in Austral 7 Mc mobile. Many amateurs are equipping their cars with transmitters and receiver that they can enjoy contacts with other amateurs from the road. While the problem designing effective transmitters and receivers are fairly well known, there are a numbe important factors, not so well known, which must be considered in designing an effic aerial system.

by Maurice Findlay

Even before the war a great deal of mobile work was carried out on the VHF bands.

The development of mobile radio systems at VHF has been accompanied by the development of suitable aerial systems on a commercial basis. In any case, on both the 56 to 60 Mc. and the 144 to 148 Mc. bands the dimensions of many of the usual aerial systems used by amateurs for their main stations are small enough to permit them to be used in a car.

The interest in the lower frequencies is brought about by the fact that it is normal to be able to work over much greater distances on the lower frequencies in the presence of interfering hills, etc., than on the VHF bands. Interstate 7 Mc. contacts are the normal order of things in eastern Australia. They are uncommon on the VHF bands even with 100-watt home stations and highly efficient aerials.

When travelling either on business or holiday there is a good deal of fun to be had contacting stations in towns as you pass through or perhaps keeping in touch with friends back home.

Amateurs in America an countries make extensive use other than 7 Mc. for mobile and some justification of the loc is needed. In the United Sta the 28 Mc. band and the 3.5 M are extensively used, and muc literature deals with these freque

The reason for our choice i concerned with the relative u of the various bands in this co few hours' listening, at different the day, with a receiver capable ing all the amateur bands will reader an excellent idea of bands are used.

SURVEY OF BANDS

The lowest frequency band a amateurs in this country is fro 3.8 Mc. A halfwave aerial is long, which makes it difficult to most locations. While the band used in both Australia and New during the winter months, atm noise is a problem during the The band is mainly useful du hours of darkness.

The 7 to 7.15 Mc. band is o most widely used for suburban terstate networks. The normal dipole aerial is 66 feet long, whi that an efficient radiator can b within the confines of most building blocks.

With ideal conditions, the ra be worldwide after dark, while contacts in daylight hours are mal order of things. There is s some static during the summer

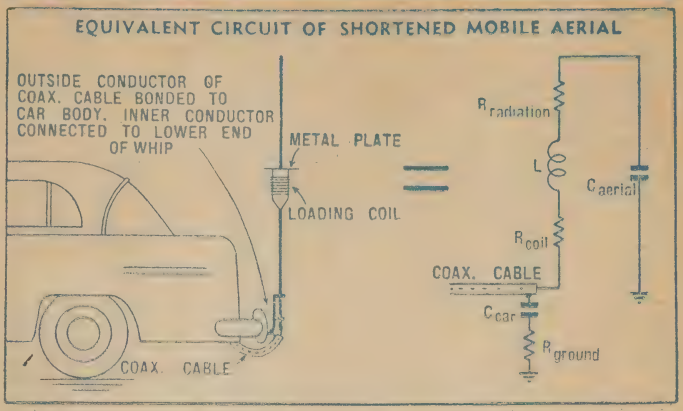
but the level is usually low en it not to be a problem.

The concentration of amateu within this band in Australia is est of any, and even amateurs periment mainly on the higher f and VHF bands usually mainta equipment in order to arrange and tests.

The 14 and 21 Mc. bands a times used for interstate commu but most of the amateurs usi bands are interested in contacti seas stations.

An amateur with mobile e would make plenty of local and terstate contacts, but overseas would be unusual because of th power and relatively low effic practical aerials. There is

THEORETICAL DIAGRAM OF AERIAL



The equivalent circuit at the right shows that power absorbed by the aerial is dissipated in three resistances. Only the power in R-radation is usefully radiated and this may be a small fraction of the total

Sydney amateur may be able risbane, but he may not be rk Newcastle.

emarks apply to the 28 Mc t that the aerial length now ort enough for an efficient be installed on a car and the ellent for local mobile work. the population on this band small and. in general, you contact as many stations as er frequency bands.

ion efficiency can be very certain conditions and plenty s contacts have been made le equipment. Long distance made mainly during daylight l conditions are likely to dly.

ica, where the amateur popu- ty is much greater than here. bile operation has many re- ffer.

OT VHF?

Mc and 144 Mc are excellent nobile work and there are nthusiastic amateurs who have equipment for these bands. , the 144 Mc band appears ore popular, probably because act, highly directional arrays tructed in a very small space. he fact that the efficiency of actical mobile aerials is rela- 7 Mc is probably the best nich to try mobile operation, at least. Therefore all of the ve have to make on practical als refer to this band.

ords about transmitters and r mobile operation may be It is possible that we will describe some equipment at but a few general remarks complete the story in the aders who have had no pre- ience.

the first experiments carried ralian amateurs make use of posals equipment.

Set No. 11, which was avail- ge quantities just after the ten used and with a remark- of success. However, the advantages of this set are large and heavy by modern nd the effective RF power uite low. Grid modulation bon microphone results in o quality than is generally the amateur bands.

EASY WAY

Set No. 22 and the No. 122 les facilities for crystal con- th much lighter, somewhat more economical of power. microphone plus plate modu- much better audio quality. ve found that there are cer- lations which can be carried ove them even further.

ons and additions have to be n sets to allow the operation which is virtually essential operation if you are not to uble with the traffic police. n be tuned to almost any nit difficulty.

ers are sensitive and selective battery valves and the fila- kely to be damaged if con- higher than normal voltage rs across a car battery under charge. A series resistor should be switched into circuit if operation with the generator charging is required.

The power output of some of the smaller dry battery sets, of which the 108 is an example, is very low and the range severely restricted.

"Command" transmitters and receivers have been modified to operate efficiently on the amateur bands but often the work involved is almost as great as if the equipment had been built from scratch.

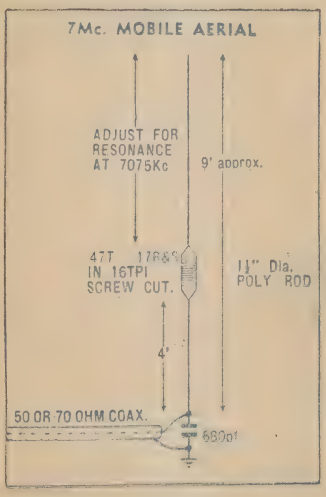
Of the home-made transmitters which have been operated successfully, the lowest power inputs have been around the 5-watt level. As the power input is increased, eventually a stage is reached where the drain on the car's electrical system becomes excessive.

It is generally considered that the highest practical power input, in the absence of special charging facilities and assuming a modern car with an efficient voltage and current regulating system, is 30 watts.

Crystal controlled transmitters have been used, but a stable variable frequency oscillator is highly desirable in order that the best transmitting frequency can be selected as required.

On the receiver side, the tendency is to make use of the car's normal broadcast receiver. A converter can be fed into the receiver which is used as an IF channel. The converter can be crystal controlled, in which case the normal tuning dial of the receiver may be used to tune amateur stations.

In general the system works well, although the addition of a noise limiter to the broadcast receiver is desirable and the broadcast receiver IF channel is often a little less selective than the ideal.



After a number of experiments, this is the aerial we recommend as a good compromise between efficiency and physical size.

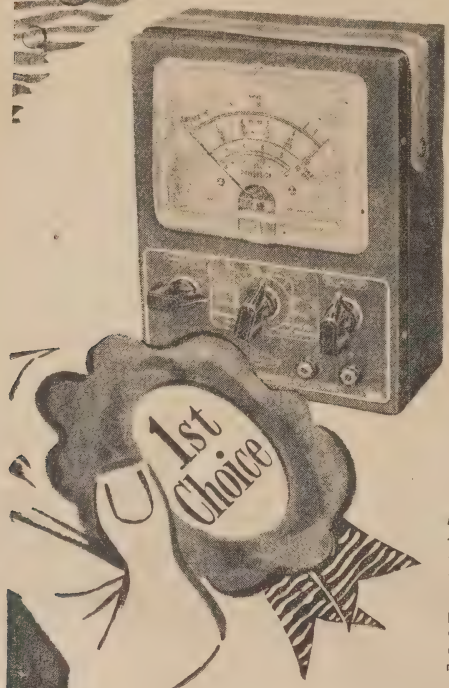
DESIGN OF AERIALS

So much for the general introduction. The remainder of the article will be devoted to, first, a theoretical discussion of mobile aerials, and, finally, to constructional details of practical solutions.

A normal independently resonant aerial for 7 Mc operation is approximately 67 feet long. It is most frequently mounted horizontally and between 30 and 60 feet above ground, depending upon available supports.

Feed methods vary from tuned lines attached to one end of the aerial, to 72 ohm ribbon feeding into the centre. The details of the method of transferring the power from the transmitter to the aerial are not of great concern at the moment. The main point is that the 67-foot length allows the aerial to be self-resonant. Having a self-resonant aerial makes it relatively simple to arrange the feeders so that the load presented to the transmitter looks like a resistance.

It is possible to reduce the physical length of an aerial by various means



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intaining resonance. For ex-
33-foot wire at right angles to
of a large conducting surface
) and with one end just above
erate as an efficient aerial. The
g surface behaves as a mirror
lly supplies the missing 33-foot
. A transmitter fed between
nd the end of the wire will
though it is feeding into a pure
(Not necessarily 72 ohms.)

e of aerial generally used for
eration in a car is actually a
nt of this "groundplane" aerial
usly there would be serious
to mobile operation if the
to be 33ft long and the lower
in good electrical contact with
d.

DY GROUND

gh the body of a car, bus or
normally well insulated from
ecause of the presence of
es, the radio frequency react-
elatively low because of the
etween the car body and the
or most of the discussion on
rials and transmitters, a good
n to the body of the car can
ed as a connection to earth.

ar owners will feel that the
actical whip aerial is 10 feet.
amateurs frequently use a whip
long but their choice is affec-
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opular for mobile work in the
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ssible to make an aerial, be it
5 or any length up to 33 feet,
at 7 Mc by adding inductance

most things in life, you don't
hing for nothing. The disad-
f the shortened aerial is that
efficient as a full-length aerial.
l, the nearer the aerial ap-
he normal physical length, the
e percentage of power which
efully radiated and the smaller
of power which will be
simply heating the structure
ial itself.

f the research which has gone
ened mobile aerials has been
improving the radiation effici-
e maintaining it reasonably
rugged enough to withstand
nical abuse it is likely to meet
illed on a car.

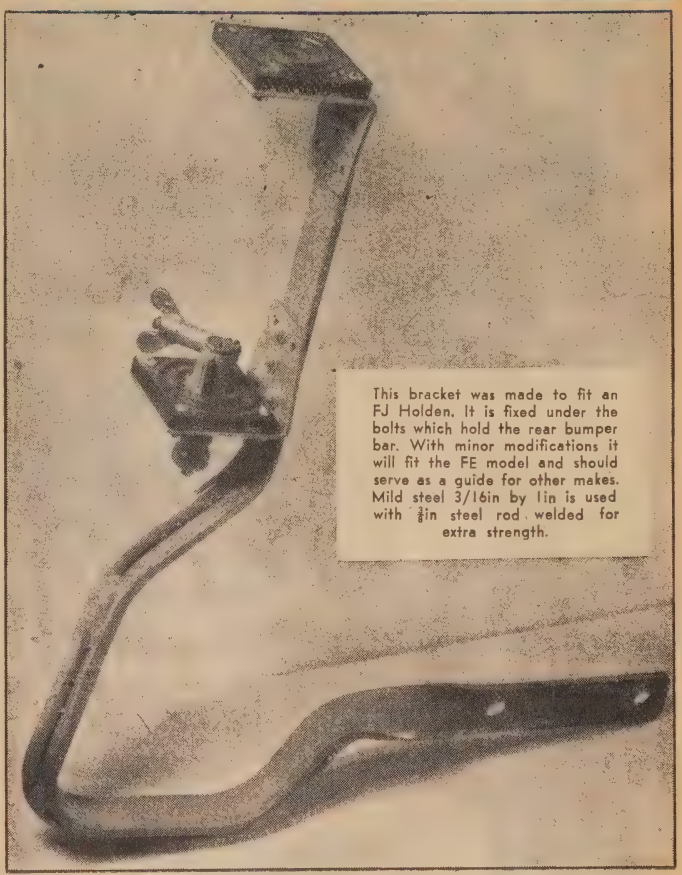
ERIALS

oretical and experimental work
done with loop aerials (Web-
bile Loop Antennas," QST,
) and there may be cases when
ld be well worth considering.
our own feeling is that they
to be more bulky and preju-
rmal use of the car more than
al whip aerials.

point, it is appropriate to con-
uivalent circuit of a shortened
discuss on a quantitative basis
making it resonant and the
fficiencies which can be ex-

ssay that we have a simple
10-foot whip mounted on
the car. Further, that we
rminals, one mounted on the
e car close to the base of

BRACKET SAVES DRILLING CAR BODY



This bracket was made to fit an FJ Holden. It is fixed under the bolts which hold the rear bumper bar. With minor modifications it will fit the FE model and should serve as a guide for other makes. Mild steel 3/16in by 1in is used with ⅜in steel rod welded for extra strength.

the aerial, and the other at the base of the aerial.

We are interested in making use of this aerial for transmitting at 7 Mc so we make some measurements with a series of laboratory instruments to determine the equivalent circuit of the aerial at 7 Mc.

After measurements and rechecking, we come to the conclusion that the aerial looks like a small value capacitor in series with a small value resistor.

The reactance of the capacitor is quite high compared with the resistance and a high voltage must be applied between the terminals in order to make an appreciable current flow

The resistance value is made up of at least three factors. The first is the radio frequency resistance of the rod itself, the second the resistance of the ground surrounding the car which provides part of the return circuit, and the third is a useful sort of resistance we can label "radiation resistance."

This radiation resistance is a mathematical convenience which we can insert into the circuit to account for the energy which is usefully radiated into the atmosphere.

The resistance of the rod itself to radio frequency currents is usually low enough to neglect, the resistance of the ground varies but could easily account for up to 10 ohms, while the radiation resistance may be only one or two ohms. This means that, even when we supply the high voltage at the end of the aerial, only a small part of the total power supplied will be usefully radiated.

FEED METHOD

It is usually most convenient to feed the aerial with a low impedance coaxial cable because this permits the transmitter to be placed within any reasonable distance of the aerial. Also it is often easy to arrange a means of adjusting the loading on a transmitter feeding its power into a low impedance line.

The lower end of the aerial must then also be made to look like a low impedance so that power in reasonable amounts can be transferred to the aerial.

Remembering that the straight rod aerial looks like a small value capacitor, input impedance can be made lower and resistive by inserting an inductance in series with the whip, the value of the inductance being such as to exactly cancel

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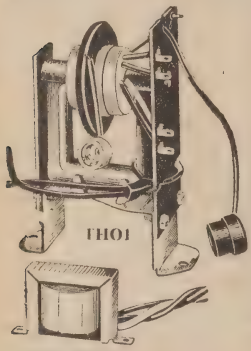
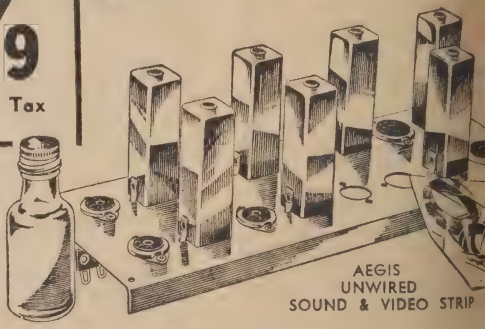


THO1

TVB1 40066

78/9 Including Sales Tax



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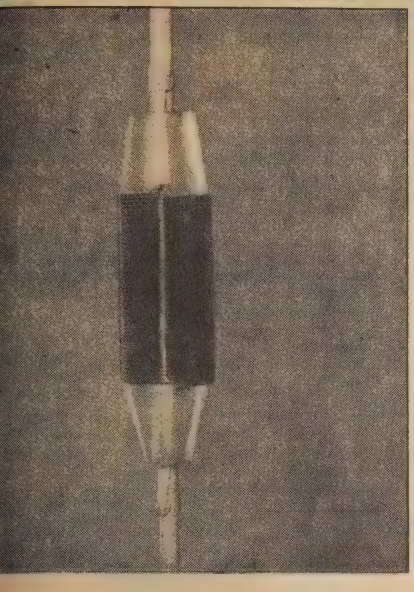
WO EXAMPLES OF 7MC AERIAL LOADING COILS



n diam. loading coil used with the 9ft whip. Turns are in a shallow groove cut at 16 TPI. The ends of the coil ught out through holes drilled parallel with the axis of and soldered to brass tabs. The tabs should be soldered aerial rods before assembly to avoid heating the polystyrene.

The loading coil and capacitive hat used in our original experiments with 10ft centre loaded whip. It is 2in diam. and the capacitive hat is 2in above the top of the coil. Q meter measurements proved the hat did have some damping effect on the coil but the effect of the aerial rods was so low that it could not be measured.

tive reactance at 7 Mc.

parent resistance between the of the aerial and ground will nade up of the ground resist- radiation resistance, and the uency resistance of the induc- with the best coils it is possible the additional resistance added l will be several ohms, all of s to waste the radio frequency ch is so expensive to generate place.

CAL EFFICIENCIES

iation efficiency of the aerial nes the ratio of the radiation to the total resistance in the

rs considered on a quantitative ould not be unreasonable for radiation efficiency to be only en when every care is taken. tem is out of adjustment or ty coils are used, this could ome 1 or 2 p.c., with the ne transmitter being restricted

at the equivalent circuit of a aerial we have drawn, let us e various components and see e done to make the radiation s high as possible.

citor C-car is large enough for e to be small compared with ce of the aerial capacitance need not be considered. In bout all you could do about to buy a bigger car. Like- is nothing practical which can out the ground resistance.

, there is something we can he radiation resistance. First of all, we can make the aerial as long as possible. Then, instead of mounting the loading coil at the base of the whip we can place it further up and thereby gain an increase in radiation resistance.

However, the further up the aerial, the smaller the capacity C-aerial above the coil and the larger the amount of inductance required. The larger the inductance, the greater the loss resistance we introduce into the circuit. If we place the loading coil at the top of the aerial, we will increase the radiation resistance greatly but the additional coil resistance will mean that the efficiency will be low.

It works out that the optimum position of the loading coil depends on the ground resistance but, in general, it is in the vicinity of the centre. Overall, the power gain in placing the loading coil at the centre rather than at the base of the whip is likely to be of the order of 1¼ to 1.

BASE V. CENTRE LOADING

Some may argue in favour of base loading, but we feel that it is not too hard to make a satisfactory centre loaded whip, and that the extra effective power is worth while. Most of our practical experiments have been carried out with centre loading.

Efficiency can be improved by reducing the losses in the coil. The diameter of the coil should be made as large as possible, the wire should be large diameter and, if practical, silver plated to reduce the skin resistance. The coil former should be made of material with losses as low as possible consistent with mechanical strength. If it were possible to make the coil with no former at all, this would be an advantage from an electrical point of view.

Some of the better quality ceramics which are fired at very high temperatures and with fine clays probably represent the best practical coil formers but the difficulty is that few if any constructors would have the facilities to produce the particular shape and size for the job.

On the other hand, it is possible to buy polystyrene rod and, provided certain precautions are observed in grinding the tools to suit the material, it can be machined with little difficulty. Both the insulating qualities and the mechanical strength are acceptable.

CAPACITIVE HATS

Even assuming all possible precautions have been taken, there is a practical lower limit to the losses in a given inductance. If, however, we increase the capacity of the aerial above the loading coil we can reduce its inductance and hence the losses due to its resistance. Provided air is used as the dielectric, the losses of the additional capacitor can be neglected and we stand to make a clear gain in efficiency.

The radiation resistance is increased by placing the capacitive hat as high as possible. In fact, the best place for it, on all counts, would be the top. For mechanical reasons this is not often practical.

Now for the practical work.

With the foregoing principles in mind, we set out to make what we hoped would be an efficient 7 Mc aerial. We decided that we would use centre loading and that the overall length of the aerial would be no greater than 10 feet.

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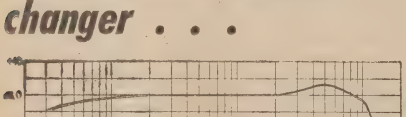

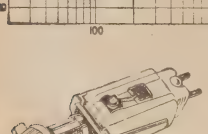

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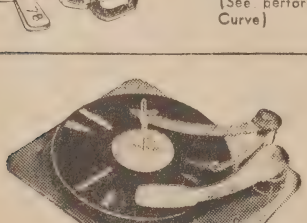

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THE COIL

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lf circles are completely

overlapping and maximum capacity when they are apart to form a complete circle. The range of tuning with this system is sufficient to allow good efficiency over the 7 to 7.15 Mc band.

When you are ready to make the final adjustment, the car should be taken well away from all metal objects and the capacitive disc set at about half its range. The number of turns should then be adjusted for resonance in the centre of the band.

You will be lucky if you get the exact point with an integral number of turns, in which case we suggest that you wind on the extra turn, finally secure the coil and establish resonance by snipping pieces off the end of the aerial, a half-inch at a time, just to be on the safe side.

In general, the resistance looking into the end of the aerial will be less than the impedance of normal co-axial cable, i.e., 50 or 70 ohms. This will mean that there will be some reflection and standing waves will appear on the line.

In a normal installation, the length will be so short that the losses will be negligible and there will be no difficulty in loading the transmitter.

However, if a correct match between aerial and the line is required, it is possible to achieve this in two ways. The inductance of the loading coil can be reduced and an inductor placed between the end of the aerial and ground. The cable is connected across the inductor.

MATCHING THE LINE

We have found the alternative more convenient. The inductance of the loading coil, or the length of the top section is increased slightly and a capacitor placed between the end of the aerial and ground. The coax. cable is connected across the capacitor. Suitable values are given in the diagram of the suggested aerial.

The initial tests on the aerial were made with a 122 transceiver and were most encouraging. Other amateurs as far away as South Australia and Tasmania were worked several times during daylight hours from Sydney suburbs. It became a matter of routine to work stations around N.S.W. from the same general location and most of the signal strength reports were excellent.

The power input to the final amplifier in the transceiver was 16 watts. A crystal mic. had been substituted for the dynamic, the overall frequency response characteristic adjusted to that considered most suitable for the operator's voice and the gain adjusted for 100 per cent modulation on peaks.

We were perfectly satisfied with the electrical performance of the 10ft whip and it was used for several months. At the same time, however, we felt that it was too big and heavy for permanent use, especially on a recently acquired new car. Accordingly, using the original aerial as a standard, we set about a series of experiments to see what could be done to reduce the dimensions of the aerial without sacrificing too much efficiency.

MEASUREMENTS ON COILS

For a start a 1¼in diam coil with about the same inductance was wound on a poly form. With the aid of a Marconi Q meter the Q of this coil was measured and found to be 250. However, a measurement on the 2in coil showed that the Q was also 250 rather than close to 300 as we would have expected.

It was subsequently proved that the loss was due to the damping effect of the capacitive hat. Lesson No. 1: The hat should have been about 6in above the coil.

Time did not permit field experiments to see if moving the hat further up made a significant improvement in the radiated power. By this time we had come to regard the aerial as too large and heavy for general use.

Since it was less than half the weight it was decided that it was worth continuing with the 1¼in coil and a 5ft centre loaded aerial was mounted in front of the windscreen on the left-hand side, the position normally occupied by the broadcast aerial. An 8in diam capacitive hat was mounted 6in above the coil and the inductance adjusted for resonance.

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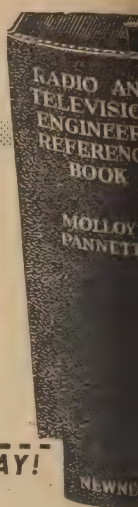

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rength meter was set up and iver with an S meter at a about four miles airline in eck that the local readings a true indication of per-

cated that the 5ft aerial was of 8db down on the original This fact plus the cumber-arance of the aerial when the front of the car made abandon the aerial and the f the work was concentrated hips at the back of the car. the driver's side of the car n its favour.

h and without the 8in diam at and with whips of the and 9ft long indicated that en mounted 6in above the same tuning effect as about p at the top.

ACITIVE HAT

ent feeling is that the extra sier to install, less liable to looks less cumbersome than Therefore, our second aerial apacitive hat, but is slightly originally thought desirable. aerial, shown in the photo-ft long centre loaded and consisting of 47 turns wound 16 TPI screw cut on 1¼in rod. The wire gauge is 17

this aerial against the much cumbersome 10ft whip indi-he radiated power for the is about 1.5 db down. nd contact we had with the still using the 122, was with amateur and the report was

it would appear that loaded d be quite a practical solu-e flat-dwelling amateur who ct a normal aerial for the ency bands. A fixed whip ably be made longer than 9 ich would increase efficiency.

a few practical points on djustment and operation of re loaded aerial. und that a 680 pF capacitor r end (see diagram) gave a g wave ratio on the coax ordinary 20 per cent toler-nit is perfectly suitable.

G LINE

not detect any reduction in with the flat line, but it he advantage that the load e transmitter end is little line length. The capacitor trouble to install that it is

pF will shift the resonant out 50 Kc higher. istment of the resonant fre-ld be made by adjusting the he whip above the loading with greater length than After the coil has been per-cured, its ends soldered to n bottom rods and the com-nstalled in its final position, an be established by cut-engths off the top. n inch cut off the top will frequency by approximately

esting to note that changing elow the loading coil has a nor effect on resonant fre-extra 4ft section lowered frequency by only about 60 Kc. This is partly due to the fact that, with the extra section in place, the capacity between the top of the whip and the car body is reduced.

A practical point arising from this is that the resonant frequency can be checked by placing a loop at the lower end of the aerial.

We suggest that you check resonance with the coax. disconnected, a 1in diam. one turn loop between the 680 pF capacitor and ground and a grid-dip oscillator coupled into this loop. A good indication can be obtained with very loose coupling between the two.

A receiver whose calibrations are known to be accurate should be used to check the G.D.O., since it cannot be expected to have the accuracy required.

The loop can be left in place for subsequent checks or removed, as you wish. In either case the change in resonant frequency and efficiency of the system will be negligible.

Checks of the resonant frequency of the system with a loop at the transmitter end of the coax. can be misleading if the line is not perfectly flat.

Field strength meter tests showed that the efficiency of the aerial with the extra 4ft bottom section was about 3db better than the 9ft whip alone. You may find it convenient to carry an extra section and plug it in for contacts when the car is not moving. In this case it would be convenient to resonate the 9ft aerial at 7,100 Kc.

Because of its high Q, the aerial exhibits reactive effect at frequencies quite close to its resonant frequency. Within limits, reactive components can be tuned out at the transmitter, even through a length of coax. We found that, provided the transmitter was retuned for best results, the transmitting frequency had to be shifted 100 Kc from aerial resonance for the radiated signal to be 3db down. The difference at 50 Kc off resonance was small.

AERIAL BANDWIDTH

In practice, this means that an aerial resonated at 7,075 Kc will cover the 7,000 to 7,150 Kc band with reasonable efficiency.

Future plans at the writer's station include a complete new installation to replace the 122 set. For reception a crystal controlled converter with an RF stage will feed into the car's normal broadcast receiver.

The transmitter will run 30 watts input to a 2E26 in the final amplifier. For frequency control, there will be a choice of crystal or VFO. A class B modulator will include speech clipping, filtering and AGC, while a dynamic mic. is to be used in place of the crystal because of the possibility of the latter failing at the high temperatures encountered in closed cars in the sun.

Transistors were considered for the modulator, but at this stage it is difficult to obtain the required 15 watts of audio, especially at high temperatures, and a high tension supply is required for the RF section in any case.

The transmitter and converter will be installed in a metal case 12in by 6¼in by 3¾in, mounted under the glove-box of the FE Holden in such a way that it does not interfere with passenger leg-room, while the genemotor supplying the HT and its associated relays will be mounted in the engine compartment.

Continued on Page 124)

USED RADIO SETS

Special Offer!

'14 Days Money Back Guarantee' If not completely satisfied.

All well-known makes

PHILIPS, A.W.A., KRIESLER, S.T.C., H.M.V., ETC

4 valve mantel models £10/-/-
5 valve mantel models £12/10/-
5 valve D/wave models £15/-/-
4 valve 2-way portables £10/-/-
5 valve 2-way portables £13/-/-
6 valve 2-way portables £16/-/-

Some of these sets have only been used for demonstration, and are quite equal to new.

REMEMBER—YOU CAN'T LOSE WITH OUR MONEY BACK GUARANTEE

THE RADIO MART

439 PITT STREET, SYDNEY
Tel. MA2351

HOME-STUDY RADIO COURSE FOR AMATEURS

STOTT'S can train YOU Successfully!

This Popular Radio Course provides a comprehensive training of the highest standard, under the expert guidance of Specialists.

It has been especially prepared for Amateurs, Dealers, Radio Salesmen, Experimenters, Servicemen, etc.

STOTT'S COURSE WILL HELP YOU.

Write today for details.

Stott's Correspondence College

100 Russell St., Melbourne; 149 Castlereagh St., Sydney; 290 Adelaide St., Brisbane; 21 Grenfell St., Adelaide; 254 Murray St., Perth.

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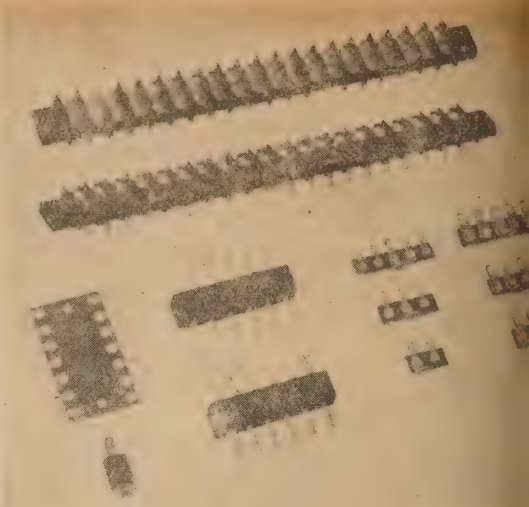
To STOTT'S: Please send me, free and without obligation, full particulars of your Course RADIO FOR AMATEURS.

My Name.....

Address.....

RH 758 ..... Age .....

"MEEMADE"
TERMINATIONS for Electronic and Electrical Industries



Range includes:

Barrier Terminal Strips. 1 to 20 pair.
Radio Type Tag Strips and Panels—All Combinations.
Moulded Type Communication Terminal Blocks. 4 to 10 points.

Suppliers to Manufacturers and Wholesalers Only.

GORDON F. MEE *'Specialised Electronic Prod*
6 ROWERN COURT, Box Hill, Victoria, E11

Do You Laugh Your Greatest Powers Away?

THOSE STRANGE INNER URGES

You have heard the phrase, "Laugh, clown, laugh." Well, that fits me perfectly. I'd fret, worry and try to reason my way out of difficulties—all to no avail; then I'd have a hunch, a something within that would tell me to do a certain thing. I'd laugh it off with a shrug. I knew too much, I thought, to heed these impressions. Well, it's different now—I've learned to use this inner power and I no longer make the mistakes I did because I do the right thing at the right time

This FREE BOOK Will Prove What Your Mind Can Do!

Here is how I got started right. I had heard about hypnosis revealing past lives. I began to think there must be some inner intelligence with which we were born. In fact, I often heard it said there was; but how could I use it, how could I make it work for me daily? That was my problem. I wanted to learn to direct this inner voice, master it if I could. Finally, I wrote to the Rosicrucians, a world wide fraternity of progressive men and women, who offered to send me, without obligation, a free book entitled "The Mastery of Life."

That book opened a new world to me. I advise *you* to write to-day and ask for your copy. *It will prove to you* what your mind can demonstrate. Don't go through life laughing your mental powers away. Use the coupon below or write: Scribe X.U.W

USE THIS GIFT COUPON

SCRIBE X.U.W
The Rosicrucians (AMORC)
Box 3988, G.P.O., Sydney, Australia.

Please send free copy of *The Mastery of Life*, which I shall read as directed.

Name .....
Address .....
City ..... State .....

The **ROSICRUCIANS** (AMORC), Box 3988, G.P.O., Sydney Aus

PS GM6008 IS VERSATILE TESTER

GM6008 is a high quality instrument for measuring voltages ts, both AC and DC, resistance and capacitance values. It nd many applications in the well equipped laboratory.

of the instrument is a e valve voltmeter using a es. Rectification for ranges nating currents is provided ic diode while a voltage er supply ensures that ins voltage do not affect

s in the range 0-300 volts in six ranges, the lowest t. Measurements within made via a probe which input resistance of 20 e accuracy is given by the as 2 per cent.

t range with an input 0 meg. is also available nel terminal. The high type GM4579B permits l high-voltage ranges, be- and 0-30 kV. The input out 900 meg. in all cases. obe permits the measure- nating voltages between 0 he error is within 3 per quency range between 40 Kc. A second cap is de- ace the normal cap for at VHF.

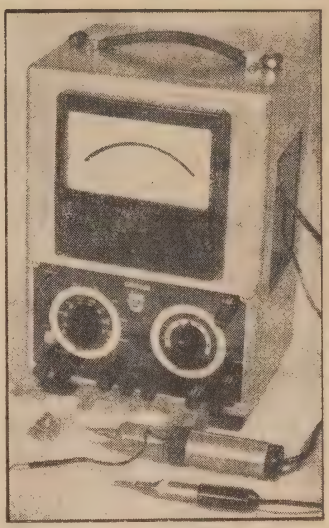
In addition to the D.C. ranges between 0-300 uA and 0-1000 mA, there is a similar set of A.C. ranges which will be found very useful. The normal frequency range is 40 cps. to 1 Kc, but the error is less than 5 per cent at 10 Kc.

Resistances between 1 ohm and 1,000 megohms can be measured on eight resistance scales. Near the centre of the scale, the accuracy can be expected to be of the order of 10 per cent.

A similar accuracy applies to the capacitance ranges which have full scale values between 0 to 300 pF and 0-3 uF.

Calibration of the valve amplifier bridge is referred to the in-built voltage reference tube so that slight changes in valve and resistor characteristics are automatically compensated during the setting-up procedure.

In use on the bench, we found the ingenious test prod fitted to the probes of great value. It fits positively into the calibration and return sockets of the instrument, on the edge of chassis, around wires at the same time as permitting easy checks around miniature sockets.



The Philips GM6008 is a high quality measuring instrument designed to maintain its accuracy over a long period of time.

N PLASTIC FILM CAPACITORS

nt forward step in capacitor engineering is marked by the n of plastic film capacitors of which the Ducon type DFB - "Styroseal" capacitors are an example.

c is a thin film of speci- ted polystyrene. This actically inert and there- itors should have a very the same time the insula-

tion resistance is extremely high, the losses very low, the resistance to humidity good and the capacity value stable with respect to changes in temperature.

It is anticipated that these capacitors will be used in many cases where mica capacitors were used previously.

Figures given by the manufacturers indicate that the insulation resistance of a typical 1 uF capacitor using a plastic dielectric would be 750,000 megohms as against 25,000 megohms for a similar mica capacitor and 10,000 megohms for an equivalent paper.

The cost structure shows up in favour of the plastic capacitors at high capacitance values.

The present range of "Styroseal" capacitors includes types designed for maximum working voltages of 200, 400, 600 and 1,000 volts D.C.

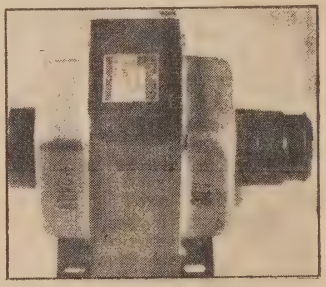
In the 200 and 400 volt ranges values between .001 uF and .022 uF are available, the dimensions of the .001 uF, 200V unit being ¼in long and 5/32in diam. and the .022 uF 400V unit ¼in long and 7/16 diam.

Capacitors in the 600V and 1,000V series are available in values from 100 pF to .01 uF, the sizes being ¼in long by 3/16in diam. and ¼in long by 17/32 diameter respectively.

32V TRANSFORMER

THE growing use of 32V appliances in homes, garages and factories is mainly due to the safety of these appliances in the event of insulation breakdown. Conventional appliances operating from the 240V mains can be very dangerous if the earth lead should break and an insulation fault occur.

Ferguson Transformers Pty. Ltd., of



Ferguson 32V transformer.

Ferguson Lane, Chatswood, N.S.W., are currently producing a series of 240V to 32V transformers for use with 32V lead lights, electric drills and etc. The transformer illustrated in the TS32/125 rated at 32V and 3.9A or alternatively 125VA. The dimensions are 3¼in by 4¼in by 6¼in overall including input connector and outlet socket. The weight is 9 lb.

Two other sizes are available, one rated at 60VA and the other at 200VA.

TELESCOPES

30 x 40 coated lens with tripod, suit rifle clubs, etc., length 28 inches, weight 1½lb.

£7/19/6

Post 4/3; Int. 5/10.

Telescopes Brand New

30-POWER. Coated Lenses.

£5/15/-

Post N.S.W. 3/4. Int. 4/6.

ALTIMETERS

Brand New. Ex R.A.A.F. 0 to 40,000 feet.

£1 each

Post N.S.W. 2/1. Int. 3/3.

MANIFOLD PRESSURE or VACUUM GAUGE

New. **£1 each**

Post N.S.W. 2/1. Int. 3/3.

AIR PRESSURE GAUGES

New 0-220lb per sq. in.

£1 each

Post N.S.W. 2/1. Int. 3/3.

MOTOR ALTERNATOR UNIT, NEW

Worth £75. Special.

50/- each

Freight payable at nearest attended Railway Station.

P8 COMPASS

Liquid filled. As new. Ex-R.A.A.F. Ideal for small boats, etc.

£3/15/- each

Post N.S.W. 4/5. Int. 5/10.

PRISMATIC COMPASSES

Ex-Army. LUMINOUS Guaranteed Correct.

£7/15/- each

Post N.S.W. 3/-. Int. 4/-.

OXYGEN BOTTLES

Ex-R.A.A.F. with indicator Brand New. 3in diam. 9in length. Weight 7lb.

£2/10/- each

Post N.S.W. 6/2. Int. 9/6.

VOLTMETER

Pocket Size.

0 to 15 volt D.C. and 0 to 250 volt D.C. In waterproof Canvas Case.

50/- each

Post 3/4. Int. 4/6.

German Field Glasses

Centre focus. Lightweight Colossal Value.

Only, per pair **35/-**

Large range binoculars and telescopes in stock. Ideal Geophysical Satellite viewing, etc.

Post N.S.W. 2/1. Int. 3/3.

TELESCOPES Ex-Army

Ottway of London.

With variable power adjustments Length 26in. Weight 12lb

£12/10/-

Freight payable at nearest attended railway station.

R.A.A.F. TARGET OSCILLATORS

£4/19/6

Freight payable at nearest attended railway station.

MULTI-METER Ex-R.A.A.F.

AC volts 0-50. DC volts 0-500. OHMS 0-1,000.

£7/10/- each

Freight payable at nearest attended Railway Station.

TRANSCEIVERS

(2-way Radio.)

Ex-Army, No. 22 Set

In excellent condition. Easily convert to suit P.M.G. requirements for use on watercraft, etc. Freq. 2-8 Mc/s 150-37.5 metres.

£18/10/-

Ex-Army, No. 128 Set

Portable. Cost £150.

Dry battery operated for lightness. Ideal for firefighting, flood rescue work.

Complete with handset, antenna, leads and accessories. Crystal controlled. Air tested

£24/10/-

Or with valves but without handset, antenna, leads or accessories.

£12/10/-

Ex-Army, No. 19 Set

With Genemotor and 15 standard Valves. Good condition.

£7/10/-

Freight payable at nearest attended Railway Station.

BALL BEARINGS

¼in-I.D. ½in-O.D.

24/- dozen

Post N.S.W. 1/9; Int. 2/9.

CONDENSERS

A.W.A. .01 5/- doz.

Block Condensers, Bakelite. .01 MF 750v DC, 6/- doz.

Ducon 400 MFD, 12 P.V., 6/- doz.

Add Postage.

DYNOMOTORS

General Electric

28v D.C. 19 Amps. Input. 1000v .35A Output.

50/- each

3/- Cartage to Rail.

Freight payable at nearest attended railway station.

0-1 MILLIAMP METER PATON

47/6

Post N.S.W. 2/1; Int. 3/3.

FIBRE PULLEYS (AMERICAN)

BALL BEARING

1 3/8in diam. ¼in shaft, 30/- doz.
1¾in diam., ¼in shaft, 42/- doz.
2 3/8in diam., 3/8in shaft, 54/-.
3½in diam. 3/8in shaft. 66/- doz.

ADD POSTAGE

AIR COMPRESSOR UNIT

BUELL U.S.A.

with Oil Trap and Air Hose.

New **£3/19/6 each**

Post N.S.W. 5/2. Int. 7/6.

AIRCRAFT GENERATOR

24v DC. 100 amp.

£17/10/-

Freight payable at nearest attended railway station.

VALVES

1.4 Miniature Series New.

1R5	12/6
1T4	10/-
1S5	10/-
3A4	12/6

OTHER VALVES, ALL NEW.

GL8020 15/-; EL5 7/6; HA2 Acorn 15/-; H30 Duo Triode 7/6; EB34 7/6; HA1 Acorn 15/-; EF8 7/6; Cathode Ray Tube with socket EL50 7/6; Type 4/1, new, 29/6.

Add Postage.

Mechanical REV. COUNTERS

Smiths or Bendix.

New 0 to 3,000 r.p.m.

£4/19/6 each

or complete with flexible drive.

£6/15/-

Post N.S.W. 3/4; Int. 4/6.

SHOCK MOUNTS

1¼in. New. Made in U.S.A.

7/6 a doz.

Post N.S.W., 1/9; Int., 3/3.

NEW MAGNETO TELEPHONE KITS

Complete do it Yourself Kit.

62/6 each

or £5/15/- for 2 sets.

Each kit comprises one Ericson Magneto, 1 Bell, 1 Handset, 1 Battery, 1 Case, 1 Handset Support and one Diagram.

Already assembled Phones.

£4/10/- each

Post N.S.W. 6/2; Int. 9/6.

AIRCRAFT MAGNETOS

Contains sundry gears, Coil, Electrical and mechanical parts.

Only 9/6 each

Plus 3/6 cartage.

Freight payable at nearest attended railway station.

CAPACITORS

1 MFDS 350v	2/-
2 MFDS 250v	2/6
4 MFDS 400v	3/-
4 MFDS 600v	4/-

Post N.S.W. 2/3; Int. 3/11.

VARIABLE CONDENSERS

Single Gang. New.

7/6 each

Post N.S.W. 2/1; Int. 3/3.

WAVEMETERS

Class C.

No. 1 Type R7647.

Range from 10,260 Kc. to 1470 Kc.

£17/10/-

Freight payable at nearest attended railway station.

OIL PRESSURE GAUGES

New. Suit Cars, Trucks, Boats, Stationary Motors, etc. 0-150lb sq. in.

£1 each

Complete with tubing.

Post N.S.W. 2/1; Int. 3/3.

AIR TEMPERAT GAUGE THERMO

0-30 minus C to 0-50

Suit Cool Rooms, Fi Works and 1,000 o

£1

Complete with in

Post N.S.W 2/1;

AIR SPEED IND

New.

£1

Post N.S.W. 2/1;

AMERICAN SI TORCH

3-cell Ideal Scouts, Wa With colour filters.

Complete— 19/

Post N.S.W. 2/1;

POTENTIOMET

50,000 to 70,000

3/6 each

Add Postage.

WHIP AERIA

Ideal for car or TV blackfish rods. 13ft sections.

19/6

Post 1/9. Int. 2

TRANSFORME

TRANNIES, midget outp

TRANNIES, I.F., 1600 K

TRANNIES, ex-Navy 5/- ea.

TRANNIES, power 0210. Prim, 6.3 Amp. Cen 5V. 2 Amp. 315-0-315

TRANNIES, 115V. 40 400 V-210-0270-400 ment. 35/- ea.

TRANNIES, 115V. to 6 10/- ea.

TRANNIES. Canadian. known, these can h 15/- ea.

TRANNIES, heavy duty put 6.3V., 5V., 325V. A.W.A., £4/15/- ea.

TRANNIES, Trimax 24 35/- ea.

TRANNIES, Trimax 230 x 6.3 at 6 Amp. 6.3, 6 Amp., 6.3 At 10 A 1.7 Amp., 35/- ea.

TRANNIES, Trimax 230 5V, C.T. 6.3 285-0-28

TRANNIES, Trimax heavy duty taps seconda

TRANNIES, heavy du 240V., 1.5 Amp. sec. V.O.15 Amp. Rating Wind double phase cycle, A.W.A. £10 e Please add post

Radio Experim

SPECIAL MI LOT

2 Potentiometers .1 me assorted Resistors, valu from ½ to 2 watts: 9 a densers: 3 Midget Ch Wound: 1 Midget Cho Wound: 1 Midget Outpu mer; 2 H.F. Transforme Reactance Ceramic: 1 h Hook Up Wire, appro lengths of Multi Core Ca

THE LOT 4

Post, N.S.W. 3/9.

TELEPHONE

Brand new.

£4/17/6 per

Freight payable at near railway statio

DEITCH BRO

70 OXFORD STREET, SYDNEY

Between Riley Stre

AL TURNOVER ARTRIDGE

CTURED in Melbourne rketed by Zephyr, the Mac- r crystal cartridge is claim- and the most stringent test temperature and humidity complete recovery on return nditions.

s include exposure to tem- the 90s and humidity of cent.

dge has a response curve

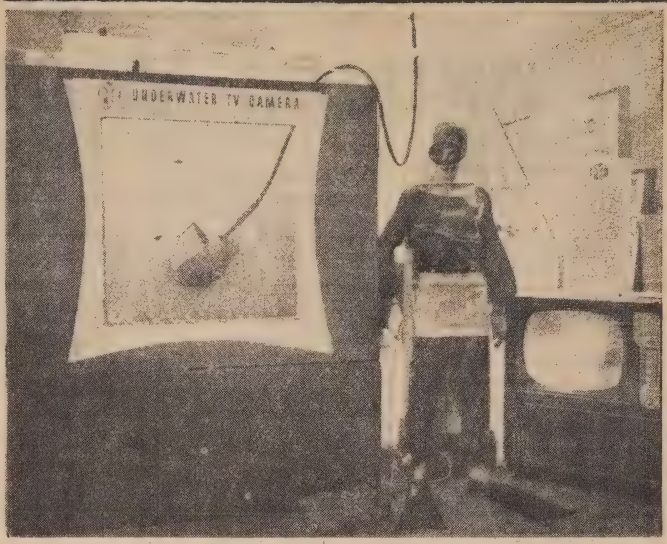
on crystal cartridge.

good general purpose unit, e housing bracket, and can with either sapphire or dia-

n is good, with positive f the replay positions. As standard arms it can be or replacement in many in-

packaged in a plastic con-

UNDERWATER TELEVISION EXHIBIT



One of the main interests at the exhibition recently held by the Pye group of companies at David Jones' store was a practical working demonstration of an underwater TV camera. The instrument was placed in a large glass tank and the output displayed on a number of Pye television receivers throughout the store.

S PRODUCE MINIMUM COST IF STRIP

e recent tendencies in TV circuit design is toward simplification strip, particularly for use in suburban areas where high signal strength makes a high overall gain unnecessary.

ith this policy the Aegis ring Co. has produced an g a minimum number of ntended to effect a worth- in cost.

t employs three video IF le sound stage, and, by the nium diodes for video de- sound discrimination, the of valves is reduced to ves employed are 6BX6s. und IF transformers are out, and two trap circuits are provided, one for 37.5 Mc adjacent channel rejection, and one at 30.5 to produce the sound plateau.

The strip has similar physical characteristics to those already used in the R. TV and H. receivers and we did, in fact, slip the sample strip into our present version for a trial.

Sensitivity appeared to be quite adequate for the type of operation envisaged, the sound could be obtained from signals too weak to produce a picture. Time did not permit a full assessment of the bandwidth characteristics, but these would seem to be at least equal to the performance claimed by the makers.

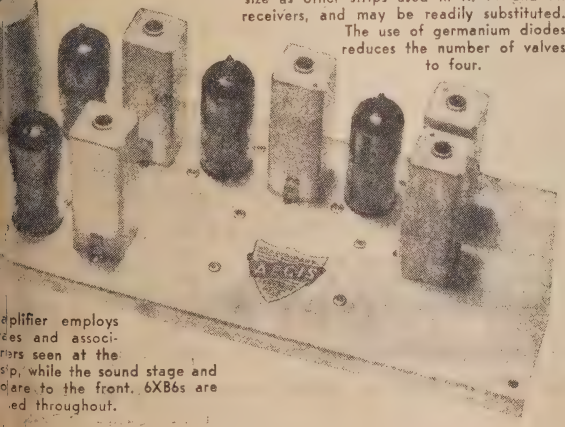
The only point of criticism concerns the AGC system. This is a simple, self contained, circuit operating from the video diode, and the voltage produced would appear to be insufficient for full control of the tuner in strong signal areas.

This, combined with the sharp cut-off characteristics of the 6BX6s, would probably make necessary the use of aerial pads in some locations. The position is further complicated by the video diode being contained within the last IF transformer can, making it difficult to fit an additional AGC diode as recommended in our latest circuit.

In spite of this, however, the strip would appear to fill a definite need, particularly where efforts are being made to cut production costs without seriously prejudicing the overall performance.

Further details from the maker, Aegis Manufacturing Co. Pty. Ltd., 208 Little Lonsdale Street, Melbourne.

The new Aegis strip is the same physical size as other strips used in R. TV and H. receivers, and may be readily substituted. The use of germanium diodes reduces the number of valves to four.



plifier employs es and associ- rs seen at the p, while the sound stage and are to the front. 6XB6s are ed throughout.

RADIOTRON BOOKS

TWO extremely interesting and useful booklets have just been released by the Amalgamated Wireless Valve Co. Pty. Ltd., and will appeal to many of our readers. One is the TV Serviceman's Guide and is a collection of the most useful articles and data published by this organisation in the previous couple of years.

The other is entitled Radiotron Transistors, and is likewise mainly reprints of articles of this new and important phase of electronics. Both are available from AWV, 47 York Street, Sydney, for a nominal subscription.

FERGUSON

NEW RELEASES—NEW APPLICATIONS

Ferguson Transformers Pty. Ltd. have pleasure in announcing the releas
new transformers and chokes and in advising the correct new and stan
types for use in equipment recently described in Radio, Television & Hob

NEW R.T. & H. 17" OR 21" TV SET

POWER TRANSFORMER TYPE PF 1193*
(as used in earlier models)
PRIMARY—200, 220, 240V, 50 cps
H.T. SEC—295-0-295V, 275mA
L.T. SEC—6.3V Tapped 5V-3A, 6.3V-9A
*At a new reduced price

FILTER CHOKE TYPE F1-285
1 Henry, 275 mA, 48 ohms D.C.

R.T. & H. 35 WATT P.A. AMPLIFIER

POWER TRANSFORMER—PF 1335
PRIMARY—230, 240V, 50 cps
H.T. SEC.—305-0-305V, 180mA
L.T. SEC.—6.3V-4A C.T. 6.3V-4A 5V-3A

OUTPUT TRANSFORMER—OPM 12
NOMINAL POWER RATING—55 Watts
FREQ. RESPONSE—50-12,000 cps ± 2 db
PRIMARY IMP. PLATE-PLATE—3500 ohms
SEC. IMP.—500, 250, 125, 83, 62, 50 ohms
Also available as Type OPM 13
with Sec. Imp. 15, 12.5, 8, 3.7, 3.1, 2 ohms

NEW FILTER CHOKES

Listed below are new Filter Chokes recently released by FERGUSON, including Type F1-285, as used in the new R.T. & H. TV receiver.

F14-60	14H	60mA	550 ohms D.C.
F6-100	6H	100mA	210 ohms D.C.
F12-100	12H	100mA	265 ohms D.C.
F1-285	1H	285mA	48 ohms D.C.
F1-325	1H	325mA	27 ohms D.C.

For details of the full FERGUSON range of Filter Chokes refer to our page in the May and June issues.

R.T. & H. TRANSISTOR TELEPHONI

DRIVER TRANSFORMER TYPE M
IMPEDANCE RATIO—1 TO 1
PRIM. D.C. RESISTANCE—275 ohms
SEC. D.C. RESISTANCE—325 ohms.

OUTPUT TRANSFORMER TYPE
POWER RATING—500mW
PRIMARY IMPEDANCE—300 ohms
SECONDARY IMPEDANCE—3.5 ohms

R.T. & H. 17 WATT P.A. AMPLI

POWER TRANSFORMER—PF
PRIMARY—230, 240V, 50 cps.
H.T. SEC.—285-0-285V, 100mA
L.T. SEC.—6.3V-2A C.T., 6.3V-2A, 5V-

OUTPUT TRANSFORMER—OP
NOMINAL POWER RATING—15 Wat
FREQ. RESPONSE—50-12,000 cps ±
PRIM. IMP.—P.P.-10,000, 8,000, 7,000
SEC. IMP.—15, 12.5, 8, 3.7, 3.1, 2 ohms
Also available as Type OPM8
with Sec. Imp.—500, 250, 166, 125, 100 o

SAFETY ISOLATING TRANSFORM

For added safety in Servicing transforme
and Radio Sets, and when using small
appliances, FERGUSON have recently
a double wound 1 to 1 ratio Isolating Tran

TYPE No. PF 1316—240v 50c
MAX. SEC. LOAD—200 VOLT-A

While nominally rated at 240V, it may
on any supply voltage 200-260V. 50 cp
your supplier for further details or writ
for full data sheet.

Individual data sheets on all of the above types available on request

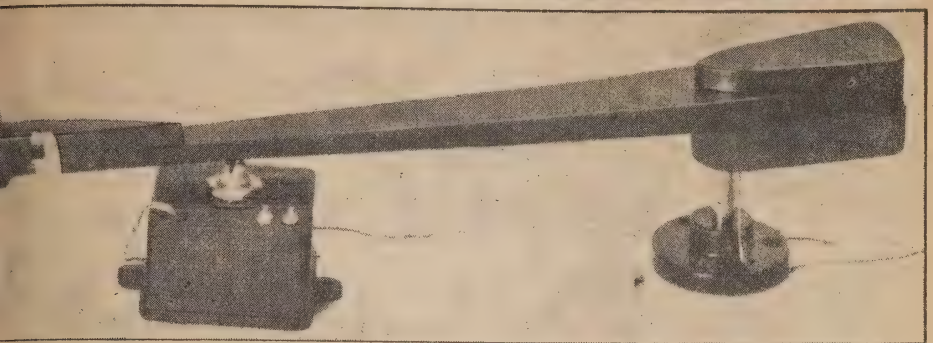
Available from all leading suppliers throughout Australia

Manufactured by

FERGUSON TRANSFORMERS PTY. L

FERGUSON LANE, CHATSWOOD, N.S.W. JA8491

OS BLACK SHADOW GIVES CRYSTAL DE-LUXE RESULTS



ave announced a new addition to their crystal pick-up line, a model the results of which are claimed to better those of any of its predecessors.

hotograph reveals, the Black w looks very much like the h in the arrangement of the he arm as well.

ference apparently is in the he unit inside the head, and on of a special compensation gives either flat or velocity ics to the output.

This pad is enclosed in a metal box, and has a switch which allows a quick change to be made.

If the pick-up is intended to play directly into a volume control which should be 100K or above, then the flat characteristic is used, giving approximately level response from an R.I.A.A curve.

The Acos Black Shadow together with the special compensation box.

Switched to velocity, the pick-up may be played into a standard type of control box which includes compensation for the R.I.A.A. or other curves.

Response in the flat position continues well up to the limit of audibility, and the bass end is characteristically solid. This frequency range is only equalled by the best pick-ups of its type. The makers claim an upper limit of 18 Kc in the flat position.

A diamond stylus is fitted as standard with the Black Shadow.

On test, feeding an amplifier with a sensitivity of about 60 millivolts, the pick-up gave evidence of its improved design in wide range and clean sound. It tracked very difficult records very well indeed, and on transient response it was bettered only by pick-ups of the very highest class.

All told, the new pick-up lives up to its claim of being the best Acos to date, and that is high praise.

Amplion (A/sia) Pty. Ltd., 101 Pyrmont Bridge Road, Camperdown, Sydney, are the Australian agents.

ANCED CRO IS VERY COMPACT

the most useful oscilloscopes we have ever handled is the pment "Serviscope" which was recently made available to us coby, Mitchell & Company P/L, of 469 Kent Street, Sydney.

the several weeks that it was laboratory, the review instruin almost constant use and sorry when the distributors it away.

here are other instruments same facilities, we have not other oscilloscope which can e same physical size and this, the secret of its usefulness.

lat-faced 3WP1 cathode ray d and the overall dimensions ½in by 8½in by 6½in. A full ion in both vertical and horictions permits a high order y in both voltage and time nts.

brilliance and other normal facilities are above re-

cal amplifier has a level re- DC to 6 Mc where it is There was no appreciable at the maximum sensitivity /cm. A panel switch permplifier to be AC coupled ation of the DC component ired.

on with good accuracy is ld by means of an internal 1- peak signal which is conailable at a panel terminal.

ly, one of the most advanced he time base which is adjustpeeds between 500 millisand 1 microsecond/cm. With sion at minimum, time interd measured with an accuracy 10 per cent while expansion diameters is possible where detail is required.

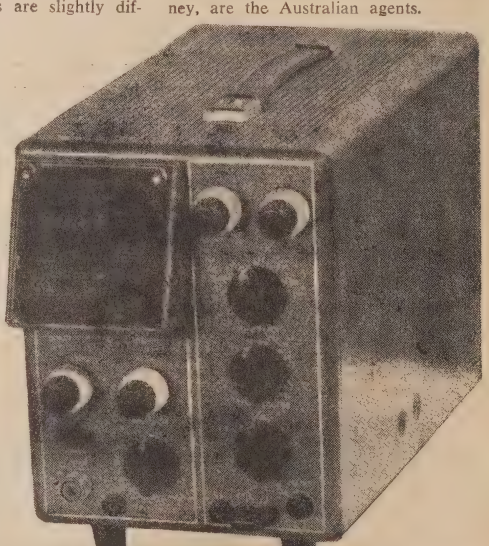
The trigger level control allows any point on the input waveform to be selected as the trigger point. The time base is rock steady even under adverse conditions.

Despite its advanced features the Serviscope is not difficult to use. The time base adjustments are slightly different from those on many earlier instruments but a few minutes' practice is sufficient to enable a relatively unskilled operator to positively lock a pattern with exactly the required number of cycles on the screen.

A durable grey hammertone finish should ensure that the neat appearance is maintained under difficult conditions. Overall weight is 16lb.

☆

The Telequipment "Serviscope" is an advanced measuring oscilloscope in a small case.



Let's Buy An Argumen

One has to be awfully careful writing these Argument column. Make one slip and/or loose statement or anything that looks like a loose statement and somebody is certai pick it up, in terms which demand recognition. And when you choose to gibe at other pe who fall into traps, well . . . . .

by Neville Williams

The big trouble is, of course, that no matter what the subject under discussion happens to be, there is certain to be some reader who knows more about it than the writer, and he's the one who jumps.

In the May issue, we were discussing technical traps citing, in particular, different methods of rating valves, operating conditions for IF strips and a nasty little fault in TV AGC systems, which causes people to tear the synch. separator apart, looking for the trouble.

ABOUT EARS

Presumably nobody had fault to find with any of this. What did receive attention was a small "fill up" item about the ability of the ears or otherwise to respond directly to RF energy from a radio station modulated at an audio rate.

If the ears are non-linear in their response, a correspondent wanted to know, why couldn't they act as a detector and make the modulation content directly available, without having to use an additional detector and earphones?

In the very limited space available for reply, I didn't have room for lengthy comment but merely said:

"Our ears may have a logarithmic response and be capable of detecting action—but only within the frequency range where they function.

"To radio frequencies, our ears presumably have NO response, therefore there can be no question of logarithmic function or of detection either.

"The circumstance would seem to be paralleled by ordinary electrical detectors which cease to function beyond certain frequency limits by reason of the swamping effects of capacitance, inductance or transit time."

Now let me say that I'm quite prepared to stand by the statement, as far as it goes, and the purpose it was made.

While not an authority on only logical to assume that tially mechanical portions of must exhibit a limited passba which frequencies are severe ated.

While some residual respo be expected to high intensity energy, I would be very su find any at all to normal quencies. And, if there's no r response, there's not much poi ing about linearity.

WANT TO ARGUE

That is, of course, unless yo happen to be N. R. or D. G. Between them these worthy have taken note of what I c crammed my journalistic mou words and then proceeded t argument on the strength of

But why should I worry? It stuff that these Argument made.

One point only would I ma proceeding. I didn't comm either on the subject of lin response. I said "Our ears M logarithmic response and be c detecting action . . . "

And again "To radio freque ears PRESUMABLY ha response . . . . "

The reason for the qualifi very simple. While experts can the structure of the hearing and deduce certain things t they cannot accurately "meas end result. They can only try to subjective reactions. And I'm an expert!

I suggest now that you rea the letters on the opposite pag ing, if you like, the Dagwood on N.R.'s face as he hastene typewriter.

"You have let yourself in last" he says.

WHO DID WHAT?

Have I? Or did he just tak carefully worded bait?

Like a cat I heard about on had a big feed of gorgonzola, th outside the mouse's hole wit breath!

N.R. maintains that the "me sections of the ear are linear movement and that the non- logarithmic function occurs w

res and brain. Since all sounds
en analysed, at this stage, into
l frequency components, no
ulation can take place.

nas much the same to say, his
nt of compromise being his
n of the ear as an "essentially"
vice. There may be more point
ualification than is immediately

also raises the question of air
RE. "biasing" the ears, then dis-

n not so sure. I wonder whether
fully analysed some of the
ffects" which people say happens
nearing with changes in altitude.
mere onlooker to physiological
, I would suggest that the
ar is, indeed, linear in so far
ternal mechanism is concerned
intermodulation between dif-
equencies would not take place.
er, there is doubtless a very
crepancy between the ideal ear
nary "production models," which
ell show degrees of mechanical
rity varying between very slight
serious.

LIKELY

vould certainly seem to line up
erved facts.

people are very sensitive to the
of intermodulation distortion
luced music, becoming immedi-
are of spurious components in
sound which nature has enabled
hear.

any other people are much less
to intermodulation distortion,
sounds as "normal" which
gard as atrocious.

t, this can be attributed to lack
education, aural carelessness and
it is that all? Is it illogical to
t such people have always had
intermodulation of the sounds
r, so that the presence of an
l quantity is not immediately

t a step further. I have met
ople who respond freely to
t ONLY when it is essentially
melodic quality and/or within
ed volume range. The moment
e becomes tonally complex or
ud, they show acute irritation.
seen these people make quite
forts to appreciate the hitherto
able and to resolve discussion
uality, etc. but without much
They just seem physically un-
o so.

DISTORTION?

e could be various explanations
along the lines of those men-
ove, but I feel that the possi-
aural non-linearity cannot be
A person with "ideal" hearing
obably react in much the same
n amplifier showing poor line-
restricted power output.

also lies the answer to N. R.'s
out the performance criteria
fiers. For one reason and an-
majority of people are not
ctical about audio quality and
of "adding expensive items to
etc., which are not necessary"
eed be largely a waste.
ot of fact, efforts along high

EARS MAY BE NON-LINEAR, BUT!

INTO A TRAP

Dear Sir,

You have let yourself in for it at last! In your "Let's Buy An Argument" article this month you commenced one paragraph (8 paragraphs from the end of the article) with the words "Nothing to do with traps . . ." That is just where you fell right into the trap and joined K.R., your correspondent. You admitted that the ear might have a logarithmic response and be capable of detecting.

If this is the case you have been responsible for adding expensive items to amplifiers, which are not necessary and are only a drain on readers' finances. Why spend money to reduce intermodulation to a fraction of a per cent, when our ear is capable of producing 10 or 20 per cent intermodulation distortion?

Another interesting fact is that if our ear were non-linear, variation of air pressure would vary the "bias" on our ear and vary the amount of distortion (I haven't noticed it. Have you?).

In actual fact our ear is essentially a linear device. It consists of numerous "tuning forks" each resonant at different frequency. When sound first enters the ear, these devices divide it into its component frequencies.

It is only after the sound is divided into its various component frequencies that it sends its impulses to the brain, with one channel for each frequency. It is the brain that is non-linear in response. But what does this matter? It isn't dealing with a mixture of sounds, but with sound of one pitch.

This would be the same as analysing a sound into its various components. Suppose we first divide into different frequencies, and amplify these frequencies separately, with one valve per frequency, and measure the intensity of each component with a meter, after it has been thus individually amplified. It will not matter how much distortion is produced in the valve: it will not detect or cause intermodulation since it is dealing with an individual frequency.

In fact if we desire to compare the ratio of the amplitudes of the different components, it would be very convenient if we would arrange for the individual amplifiers to have a logarithmic response. And this is exactly what our hearing system does.

I trust that you will be more careful to avoid falling into these traps in the future.

Yours faithfully,
N.R. (SOUTH PERTH., W.A.).

ANOTHER OPINION

Dear Sir,

I must disagree with the answer you gave to K. R. in the May issue (". . . If the ear has a logarithmic response, why does it not act as a detector and allow us to hear the audio difference frequency between two ultrasonic frequencies" — my wording). You explain this by saying that the ear has NO response to ultrasonic frequencies, logarithmic or otherwise.

However this does not explain why the logarithmic response of the ear to audio frequencies does not enable us to hear a difference frequency between, say 7Kc and 8Kc at 1Kc. Nor does it agree with the, I think, experimental fact that the ear CAN hear a difference frequency between two ultrasonic tones and HIGH INTENSITY.

The answer to K. R.'s question depends upon the exact part of the hearing process in which the admitted logarithmic response occurs. The response of the ear is linear (for sounds of normal intensity) from the ear drum, through the tiny bones of the inner ear, to the basilar membrane in the cochlea, where thousands of resonant fibres analyse the original sound into its frequency components (and of course a modulated but undetected radio frequency has no energy at the modulating frequency).

Those fibres which vibrate, indicating particular frequency components, send messages along separate nerves to the brain, and it is in this linkage from resonant fibre to the brain that the logarithmic response ocurs: that is, the sensation is proportional to the logarithm of the energy content at any particular frequency. However this non-linearity is too late to cause "detection," as the sound is already analysed into its frequency components.

A somewhat analogous situation can be found in a radio receiver, where, although intermodulation between two radio stations can be caused by a non-linear RF stage, no amount of distortion in the AF stages can give this effect.

The explanation of the fact I quoted, that the ear can hear the difference frequency between two ultrasonic tones of suitable intensity, would seem to be that for very intense sounds rattling of the coupling bones in the inner ear does introduce non-linearity before the sound is analysed.

May I congratulate you on an excellent journal.

Yours faithfully,
D. G. (Ph. D.) (GUILDFORD. W.A.)

R.F. LOUDSPEAKER

Dear Sir,

Your remarks re: the inaudibility of RF (May isue) called to mind when, a few years ago, I thought to make the perfect loudspeaker consisting of a source of supersonic waves modulated by AF.

I realised that the would-be listener would have to wear a "detector" some form of ear-plug which allowed sound waves to pass in one direction only.

As I had no idea on how to make a device of this kind, the idea lapsed.

Somebody else may have the necessary knowledge.

Yours faithfully,
N. G. N. (MILDURA).

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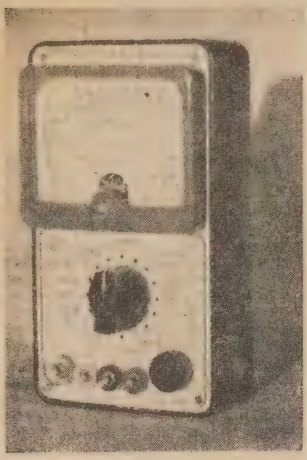

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By referring to a chart up to plus 56db. may be measured.

The case is black bakelite with a metal panel and 3-inch meter. Test leads are provided and also a leather carrying case that holds meter and leads. Sensitivity of meter is 1000 ohms per volt.

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18	19	4d	
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24	25	2d	
26	27	2d	
28	30	1d	1
29	31	1d	
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lines are aimed at a select few ave the necessary education, in- and application to appreciate it, -perhaps—with the necessary aur- ipment.

. makes some remarks about beat ncies which can and can't be

says that a beat can't be heard n two such frequencies as 7 and take it, at normal amplitudes. is a personal observation or true minority, or a majority or for ody?

says that you can hear a different ncy between two ultrasonic tones n intensity.

RE FROM?

, I've certainly heard such beats t under conditions where I could ly credit my ears with producing One would have to be very cer- at any beats heard were not com- m the amplifier chain or, where e sources were in use, from ar- n the room capable of acting as : rectifiers.

we're getting away from the If cross-modulation can occur supersonic frequencies at high de, is there any reason why the ffect should not take place be- ther frequencies of similar ampli-

ct, if the amplitude and sensiti- the whole mechanism tended to with reducing frequency, ot the intermodulation threshold ered also?

lastly, having respect to the variations in human ears, in re- frequency response, sensitivity, range and general aural health, en logical to assume that line- one will remain sacred and un- ?

lps N. R.'s rather jocular refer- 10 or 15 per cent intermodu- ightn't be so far from the truth ot of people.

re a doctor in the house? An cialist for preference.

e meantime, I think I'll stick riginal statement and leave that rd "may" in its context.

FIT TRANSFORMERS

ring the subject the letter repro- erewith, about output transfor- s not intended as an "Argument" sion. However, it was referred to nother member of the staff with e that it be treated as such, be- many readers seem to raise it ne to time. Even argue about it!

oint behind J.L.'s letter is clear h. He sees an output transformer r as an impedance matching de- wh a certain definite impedance limary to secondary.

ast is equal to the square of the rio, and one is just as definite y as the other.

seing so, a typical transformer esigned to feed, say, an 8-ohm er and present a primary imped- f 2,000 ohms—an impedance ratio 50 to 1, primary to secondary. hy could it not be used equally well, J.L. wants to know, to transform 4 ohms to 6,000 ohms?

Let me state forthwith that, in so far as impedance ratio is concerned, it could. In fact, one could invent an infinite number of possible impedance combinations, all with a ratio of 1,500 to 1.

But there is an aeronautic insect in the salve, or, shall we say, a fly in the ointment!

Being what it is, an output transformer relies entirely upon magnetic effects to couple energy from the primary to the secondary winding.

Plate current through the primary winding, varying at signal frequency, causes a corresponding variation in the magnetisation of the core material. This varying magnetic field, cutting the turns on the secondary winding, induces voltage and current in it, which is applied to the loudspeaker voice coil.

At low signal frequencies, the coupling efficiency can only be maintained if the magnetic properties of the transformer are of generous proportions, involving many turns of wire on a large, high-quality core.

ADEQUATE INDUCTANCE

In other words, for good low frequency response, the output transformer must have adequate inductance.

In quantitative terms, it may be said that a transformer needs to exhibit an inductive reactance at least equal to and preferably higher than the load resistance, at the lowest frequency which the system is required to handle.

That is a first requirement and, if taken alone, would simply mean that typical transformers would be wound with a large number of turns on a large core, so that the inductance would always be ample, no matter what the associated load happened to be.

But . . . transformers also exhibit capacitance between adjacent turns and adjacent layers, which constitutes a path by which signal currents can flow, instead of through the total length of the winding.

At low frequencies, shunt capacitance is no problem but, at high frequencies, so much signal current can be diverted through the capacitive path and away from the inductive, that the coupling efficiency and "response" of the transformer can be ruined.

For this and other reasons, transformer designers commonly subdivide the windings, minimising capacitance effects, but they also avoid putting on more turns than necessary to give the requisite inductance, knowing that every extra turn means extra capacitance.

Over and above capacitance and inductance, other considerations intrude. For a given order of output power, low values of load usually infer an output valve or an operating condition with higher than normal signal currents.

Such currents, passing through the winding, causes voltage drop in the D.C. resistance of the wire, the power so represented being wasted as heat. There is, therefore, a tendency to design a transformer, intended for low values of load, to have less D.C. resistance in the winding than a comparable component designed for a high value load.

DC RESISTANCE

Considered alone, low D.C. resistance is, of course, a commendable property in any transformer but it may have significant implications.

It may mean that the transformer has fewer turns on the windings than strictly optimum. Or, if the number of turns and the inductance is adequate, it could mean that the transformer is rather larger and more costly than is strictly necessary.

In other words, the impedance ratio of an output transformer is only one of its salient features. Its inductance, distributed capacitance and D.C. resistance are all likewise important and these relate more than anything to the order of load into which it is intended to work.

This answers J.L.'s letter in part. His further question about the degree of tolerance and its likely direction is not so easy. In fact, I doubt whether anything more than a very approximate kind of answer is possible.

Most true high fidelity transformers have a margin at both ends of the range, with inductance to spare and a minimum of capacitance. I rather expect that they would function, without obvious difficulty, for loads varying by plus and minus 50 odd per cent from the intended figure.

But there could be exceptions, in that designers adopt quite different approaches to these varying problems. Some tend to be over-generous at one end to the detriment of the other, purely as a kind of policy. Others may guide their constants to satisfy stability requirements in relation to multi-stage amplifiers, negative feedback and so on.

MAJOR ERROR?

And if major error has to be tolerated, which way is the better?

It's rather like choosing weapons for a duel. No choice is very pleasant.

Of the two, I guess I'd rather use a transformer at well below its normal load value than well above.

Related to the load, the inductance would be ample and the capacitance low. Loss due to D.C. resistance in the windings would be higher than normal but probably not so high as to be serious in a domestic amplifier system. I take is that is what J.L. is talking about.

OUTPUT TRANSFORMERS

Dear Sir,

Would you please be so kind as to inform me on the following two subjects:

(1.) If a Hi-Fi amplifier design calls for an output transformer to match 12,000 ohms plate to plate impedance to an 8 ohm speaker, would it have any disadvantage to use one that was designed to match 6,000 ohms to 4 ohms or anyone for that matter as long as the transformer ratio is retained?

(2.) If one has to err in a case like this which way is the safest, the higher the lower ratio?

Yours truly,
J. L. (NARACOORTE. S.A.).

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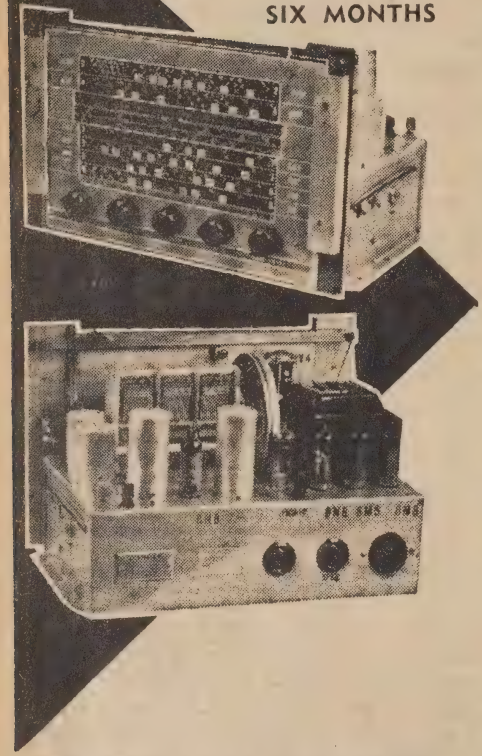

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Sensitive "magic eye" tuning indicator (EM80) making tuning simple a tive even on interstate, overseas and country stations.
All chassis are wired for the fitting of an F.M. tuner or tape recorder, plug being provided on back of chassis, also pick-up terminals and on gramo motor.
Power switch is fitted to volume control, radiogram switch, combined wi change switch. Audio end of set can be used with TV receiver if requir

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

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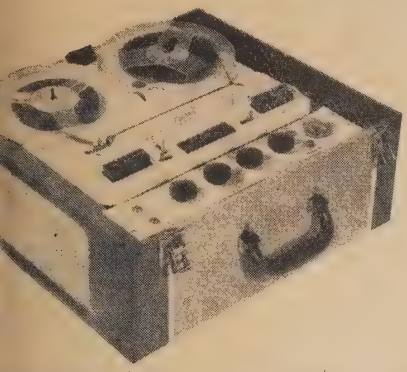

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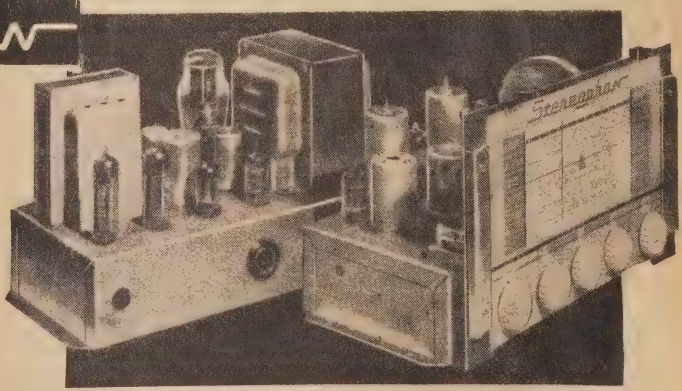

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OFF THE RECORD — NEWS & REVIEW

Added experience with the new stereo discs convinces me still further that they will success. It is too early yet to forecast how the record companies will go about rele them, but I suspect they will appear in all classes of music, some of them quite soon.

by John Moyle

As I write, none of the major firms has made a first issue, although this can't be far away.

In America, the initial list of about half-a-dozen has been very considerably augmented, and by this time some test or practice discs will probably have been released in England. So far, very few have found their way here, and mostly to individuals who have imported them.

Fortunately mine were all of good quality, although I have heard one or two copies of the same discs which apparently were badly pressed. But as the matrix numbers were different from mine, I can only suggest that the pressings are at fault. This is a pity, and may account for some luke-warm reports I have noted from some who have used them.

LITTLE WEAR

Despite considerable use, very little wear has appeared on my discs, although the stylus pressure is 7 grams.

Fundamentally there doesn't seem to be any great difficulty in pressing them, and I've no doubt that the industry as a whole is quite confident they can produce perfect discs.

When these are for sale, the price will probably be about 25 per cent up on standard LP's, although no doubt this will eventually adjust itself.

There are signs of scatter in the local industry which is largely dependent on overseas advice in any steps it might take, but I would be surprised if some discs did not make an appearance here well before Christmas.

Overseas the pick-up position is beginning to clarify. Already makers such as Pickering, Ortofon, Westrex and so on have announced highly priced models, and in England Ronette has advertised (£2/10/) its first production cartridge. Acos should not be far behind, and the Electro-Voice ceramic has been on sale in U.S.A. for some time.

Ronette offers both sapphire and diamond points.

OVERSEAS MODELS

As mentioned elsewhere in this issue, some of the luxury overseas radiogram makers have released models, and playback equipment generally is coming on the market. None of the big amplifier makers has yet announced new models, but fundamentally there isn't a major problem here. Ingenuity will probably be exercised to keep price down.

For the higher output pickups, a couple of twin triodes, and continuously variable ganged controls, shouldn't present many difficulties. I have already started to make some of these myself

I have had no more trouble using the Acos pre-production crystal pickup mentioned last month than with any other reasonably good pickup of this type.

It has been played both with the amplifier described in this issue, with substantially its correct load for level response, and with ordinary Playmaster control units loaded with .1 megs to simulate velocity characteristics.

In the absence of suitable frequency discs, I haven't tried to work to response curves, merely suiting the sound to my ear by using normal controls. It will be time enough for such matters when the final designs are received, for there are likely to be some changes in construction.

I would say that, provided the automatic action does not exert side pressure on the arm while the disc is playing, no trouble will be found in using stereo cartridges with good changers. I would be surprised if the changer people don't tell you very soon that their products can be ordered with stereo heads.

If you already have a good radiogram, some-one is going to sell you a small speaker cabinet to match up roughly with your present outfit, complete with self-contained amplifier which will be the equivalent of th ready in your 'gram.

If your playback motor is good, and stereo cartridges able to fit standard arms—th Voice for one has standard —a mechanic could make th tion without major difficulty.

A move like this could do popularise stereo. I have re ideas about radiation patterns ers. It seems that the hole in t is something that must be and a certain amount of diff overlapping in the middle re though it might degrade the of separation, might greatly he ing the co-ordinate sound, wh real purpose of stereo.

At any rate I've heard s good results with diffused a anced speakers, provided they onably good at their job. B getting on to the broader s stereo, and more will be said later on as we progress.

I still like the discs, and than ever convinced that the their job perfectly satisfactorily section of the reproduced m

Record Reviews of the mon

MAHLER—Symphony No. 4 in G major. Played by the New York Philharmonic Orchestra conducted by Bruno Walter. Coronet KLC630

Let us forget the usual comments about Mahler symphonies—that they are long, verbose and sprawling. I've heard these adjectives used enough now—I've used some of them myself—to last for quite a while. And in any case they are only partly true.

If anyone would make me forgetful of them it is Bruno Walter, for he gives here a most loving and understanding performance.

There are reams of melodic, tender and beautiful pages in the score, and he makes the most of them all. He has a touch for Mahler, with whom many lose patience or fail to understand.

It is not an easy symphony to record, either, for although it has its full climaxes, it depends a great deal on the clarity of inner parts for its many lovely effects.

Thus I appreciated the fine detail to be heard, not obtained by a forward recording, but by a cohesive, airy one.

The frequency range is particularly good for Coronet—not that its records are lacking in class, but because this one seems to have an added quality.

The highs are particularly clean, and the bass end balances it well without undue prominence.

The soprano part in the last is treated in the same way— of the orchestral texture, but immediate in its sound.

The surface is unobtrusive siderably better than average. It is a release of very hig

MOZART—Sonata No 1 major (K545); Sonata No 1 major (K331); Sonata No 1 flat major (K333). Played by Katchen. Decca LXT 5323

This is very precise and clea but many will think Katchen unsympathetic in his view of t known works.

The A major in particular better handled by others. T good deal more appeal than here.

The variations in the first are treated strictly as such. e precise and abrupt pause betw

But Katchen is a fine pian you don't look for more thar will not be disappointed.

He handles the rapid work and his reading is consistent shaped.

A bigger contrast with Giese scarcely be imagined, but then ber criticising him for being in his approach. You can't ways.

The recording is very goo The piano is nicely placed, t

FETZ PRODUCES SUPERB BRAHMS CONCERTO

RAHMS.—Violin Concerto in major Opus 77. Played by ha Heifetz, with the Chicago phony Orchestra, conducted by z Reiner. RCA L16114.

outstanding feature of this record incomparable work of Heifetz. ring it, one has ample evidence s pre-eminence in the field of s. and I don't except anyone in

ut 1940 he recorded the concerto set of 78s, which, if not remark- for their technical quality, were lly head and shoulders over any is performance.

n the memory of it still clear in nd, I found here the same clarity ught and phrasing, the complete tanding of every bar, the authori- shaping of the whole work.

hnical mastery to Heifetz has be- so much part of his playing that longer bothers to display it. To is merely a fortunate advantage allows him to treat ornaments rns for what they are, to use ed with an ease which is almost acing. He leaps from here to in an unbroken sweep that gives and logical meaning to passages others must break into pieces be- fore they get them out, if they do not get lost on the way.

All this allows him to achieve a sense of progression and movement throughout the concerto which never flags, which needs make no compromise, and which leaves us as though we have heard it for the first and only time.

But it is useless to describe such playing in words. I can only urge you to hear it, and hope that you see it as I do.

The recording as such is adequate, but not outstandingly good. Reiner's orchestra runs second to Heifetz—I almost felt it had given up the task of matching him, and was determined at all costs to keep in the race or perish.

But in truth Heifetz has a habit of submerging his accompaniments (pardon, Mr Reiner!), and certainly the orchestra does nothing to lessen the value of this disc.

There are some very good versions of the Brahms. Oistrakh has a smooth and competent one for DGG, Martzy a musical and sincere record for Columbia, and there is a most distinguished performance for Coronet from Francescatti.

But it is Heifetz who shows them how it should be done.

troduce themselves almost apologetically, and to have unbent a little more in the trio of the third movement, I doubt whether I'd be interested in hearing another version (at least for the time being).

And the Vienna Orchestra, than whom there is none better on their day, are completely at home with Mozart, as they should be.

I wonder whether anywhere there is a finer string section. Their work has warmth and breadth and dignity and a sense of radiance around which this lovely symphony is built.

The Schubert is mostly a low tension, low key job, impeccably and lovingly played.

Once again the strings give us some beautiful playing, a remark made without prejudice to the delicacy and certainty of the woodwind in the second movement.

There is no attempt to ease the nostalgia, and if you are happy to hear the symphony extended in this beguiling fashion, you'll love it.

The recording deserves the highest praise. It is excellently balanced, not merely to allow the clearest of instrumental definition but also a relaxed and

too far. Every note is crystal d Katchen must take as much this as anyone

a fine keyboard control he has. rface fortunately is quite good faint crackle is never really e.

is very tempting to find these sonatas on one disc.

NDELSSOHN—Violin Con- n E minor. Played by Fredell and the Stadium Concerts tra of New York; Octet in major played by the augmen- roll String Quartet. World Club IT4.

erformance is competent; the copes easily with most difficul- ough she tends to rush small f notes as others have done r.

ne is rather thin. She is not lly close to the microphone, and account for some of this effect. seems to be a full tone and lity in the lower strings

by no means a sentimental ton the contrary she seems to pure, fine sound rather than h

ed a tendency toward poor on several occasions.

chestral part in this concerto rong point—it is decidely fussy e orchestra manages it quite

n matters of balance etc it is rage there isn't much rever- n and both frequency and dy- ge are modest.

tet is a disarmingly melodious tten when Mendelssohn was 16. e simply scored, and there are ages in which the argument atly advanced.

nally I thought it the better side, but maybe this is a reflection of my interest in hearing a comparatively unfamiliar work. After all, the concerto faces really tough opposition, from the Oistrakhs down.

The recording has an attractive airiness which suits the music. The scherzo goes particularly well—an amazing piece of work for sixteen years old.

MOZART—Symphony No. 35 in D Major (Haffner); SCHUBERT—Symphony No. 8 in B Minor (Unfinished), played by the Vienna Philharmonic Orchestra, conducted by Carl Schuricht. Decca LXT 5257.

It would be hard to better the Haffner, one of Mozart's most lovable symphonies.

If I could have persuaded Schuricht to brighten up the opening bars, which in

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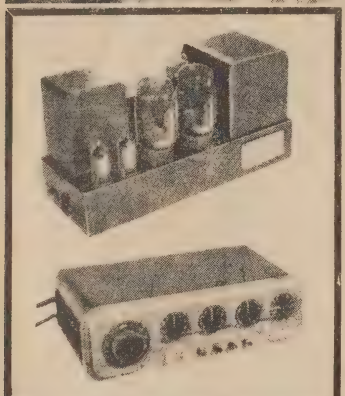

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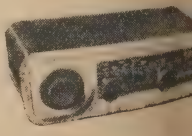

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rtioned frequency response. It the strings as free from edge and th the full range of tone, particu- he basses — powerful and com- ng when required, but never sub- l in lighter moments.

to this a good surface and you a bright, warm spot in the life of ewer.

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OUNDPROOF — The Sound of iorrow, today. Twelve popular ibers played by Ferrante and her (duo-pianists, plus electron- Westminster (W. and G.). -W-18024.

iost unusual mixture of duo-piano g, so combined with electronic and ffects as to make one believe there hole orchestra at work, composed ps, xylophones, harpsichords, gui- nd a host of un-nameable instru- and engines which assist in pro- this fascinating collection.

they are good, too, guaranteed to ou, no matter what your musical might be.

n't pure electronic music, and it ly isn't musique concrete, but its y house might be nearer the music orrow than we think. So long as addition to, and not instead of! ican Echoes" has some remark- ectronic percussive effects which t out your woofers transient re- followed immediately by an imi- f massed guitars, in "Dark Eyes" would fool anyone.

not all the sounds are meant as ns, and there are so many that ne who has worked with elec- effects or instruments would have e of identifying all of them.

et claims that each number ew and different type of sound. believe it, for rarely are the heard as the makers intended. re a pair of "gimmicked" Stein- ecording to the program notes. micks must be quite extensive. original recording was by West- using no less than 17 channels ur 6-channel mixers. All the ere controllable from the moni- ooth. Quite a set-up, but in line estminster's way.

is some surface noise, but it get much chance to be heard. the month's most interesting

★ ★ ★

BRLI... — Overtures; Roman val Opus 9, King Lear Opus 4, Corsair Opus 21, Les Francs- Opus 3, Waverley Opus 1. by the Royal Philharmonic stra, conducted by Sir Thomas am. Coronet KLC 636.

am is a specialist in Berlioz, and ison, for he shares with him a of imagination and flamboyance. ently evident, for instance, in man Carnival, and with even oint, in The Corsair.

ecording has matched the col- usic, from full deep bass to the ed cymbals and other clash and nstruments.

lut this rich air, most of the Ber- ch would be lost.

rass, too, has some striking mo- . The closing bars of the Roman is one of them.

pity to be critical of such a good disc, but added to a surface just below par, there are some disturbing groove echoes following heavy drumbeats in King Lear which shouldn't have happened. The tendency is to play most of this brilliant stuff at higher than normal level, and such things can be annoying.

To balance it out, there is a very great amount of good music for the money.

Incidentally the recording was made in America, presumably during a visit of the orchestra a few years ago.

★ ★ ★

SHOSTAKOVITCH — Symphony No. 5 Opus 47. Played by the London Philharmonic Orchestra, conducted by Artur Rodzinski. Westminster (W. and G.) WG-W-18018.

No longer strange to our ears, this symphony gets a spirited and weighty performance.

In the early days of LPs, Westminster's sound was probably the most vivid of any.

The emphasis was on close and multiple miking, and it could be mighty impressive when well done.

I was intrigued to hear this characteristic sound again after a long absence on the Australian market.

It suits the music, too, which frequently divides the orchestral sections well enough to be used for demonstration purposes.

There isn't much you don't hear

I can't place another version in my collection, but I found this one sufficiently rewarding not to lament the fact.

It has a high amplitude cut, good frequency range, and great weight when the going is rugged.

When it is good, it is very good.

Unfortunately, the surface noise is quite audible in quiet passages and at more than average volume you will pick it, particularly if your speaker is middly.

Shostakovitch is a rare mixture of a modern technique which has learned its craft from all the music of the past without rejecting any of it.

This symphony is a very good introduction if you have not already made his acquaintance.

★ ★ ★

MOZART—Symphony No 6 in F major Opus 68 (Pastoral). Played by the NBC Symphony Orchestra conducted by Arturo Toscanini, RCA LT16117.

The main value of this disc lies in the hand of Toscanini who is at his most dramatic if not his most endearing.

Most noteworthy example of his mood is found in the Storm movement.

Here are effects you will find in no other version. Instruments pop out which normally aren't heard on their own. The violent dynamics of the movement are exploited in a particularly rugged and explosive fashion —

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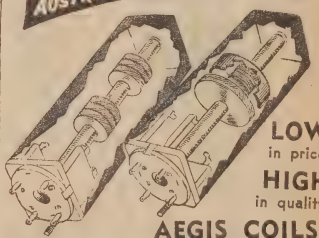

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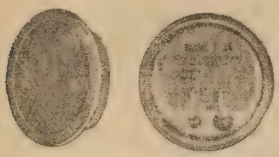

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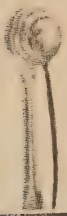

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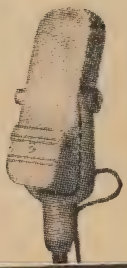

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irkly programmatic than I ever
er hearing it.
oven wrote about a storm and
i plasters it over your head
ments of sound.
conductors are satisfied to ampli-
chaos in round terms—their
are mighty mountains of noise
ing themselves about in appro-
graduated abandonment.
Toscanini illuminates the scene
te magical manner. Those dart-
umental phrases which portray
e individual incidents of the
ne movement within movement,
of the lash as well as the bludg-
e things peculiar to his imagina-

is work of the highest order.
here the intention can be fully
; but the execution sounds more
f fact than it would have done
onductor's earlier years.

DED IN 1952

of this may be due to the 1952
date and the lack of rever-
in the studio, although this
rly as noticeable as in the for-
days. But it is, I think, prejudi-
one colour.
laying is precise and well con-
but neither balance nor acou-
kes the best of it.
ency response is limited at both
bottom by today's standards.
controls don't help a great deal.
range is high, and the storm
vith a mighty impact.
is enough tradition and musci-
e in this disc to move it into
with many others from Toscan-
ill also clear your palette if it
me wearied of over-romantic or
ent versions.
are some surface crackles.

★ ★ ★

**ZART—Symphony No 38 in
or K504 (Prague); Symphony
in E flat K543. Played by
ilharmonia Orchestra, con-
by Otto Klemperer. Colum-
OCX 1486.**

t's versatility makes it very hard
nt for so much of his genius
mal kind of way. No sooner
el we have him typed than we
something new in his music
oesn't run true to form. One
wonder whether a mind which
vel in the delicious absurdities
peras could write music which
ows the more introspective and
etthoven.
e later symphonies it isn't hard
Mozart who has stepped out
ter, as it were, and, however
e might lean on the past, in-
is own, has begun to use music
ent way, to say different things,
responses in the mind which
apart from what has gone

rer shows clearly that he takes
phonies very seriously, for he
m with the same meticulous
hich was characteristic of his
Beethoven symphonies with
ost of us are now familiar.
ozart has a majestic quality
en if a little over-stated, high-
point I have been making.
believe that he sees in these
crystallisation of the compos-
nd he has laboured with great
insure that all is recognised
ered.
's Klemperer's way. Sometimes
I find it unnecessarily conscientious—I would be prepared to trade some of his meticulous exposition for more freedom and light. But in fairness it must be said that he clearly distinguishes between the illumination of Mozart and the darker shades of Beethoven, no matter how closely these can be identified in many passages.

I liked this record even better than his earlier recording of the G minor symphonies, and, however you may assess them, you will agree that both are important and individual.

The Philharmonia displays its usual standard. The recording isn't as full in tone as in some other examples but it is clean, responsive, and balanced.

I commend it very highly.

★ ★ ★

BEETHOVEN — Concerto No 2 in B flat major Opus 19. BACH — Concerto No 1 in D minor. Played by Glenn Gould (pianist) and the Columbia Symphony Orchestra conducted by Leonard Bernstein. Coronet KLC 660.

I found this a most interesting and in many ways admirable record. Musically I found myself receiving a not unexpected impression that two actively modern minds were setting themselves, rather self-consciously, to give new light to Beethoven and Bach, not so much departing from what I will call a classical conception as trying to rationalise it into the mid-century mould.

With Beethoven there is a great deal of success. There is considerable urgency about the whole thing which is rattled off with great dexterity and skill.

But there is also logic and what I am fond of calling "shape" together with a most stimulating vitality.

I liked, too, the unanimity of ideas between the orchestra and the piano. They match each other all the way through, and half the battle in creating an acceptable whole is to be consistent about it.

At least there is no doubt that both Bernstein and Gould knew exactly what they intended to do from first to last.

PURPOSEFUL PIANIST

Gould is a purposeful and facile pianist, with a clear technique, very largely in his fingers as we hear him. He does not seek for any great power, and although this was Beethoven's first concerto, and leans more to his predecessors, particularly Mozart, than those that came afterwards, there is a certain stature missing which others have managed to achieve without prejudice to other things.

The piano is very much to the fore in the matter of balance, most noticeable in the Bach, about which I was a little less happy than the Beethoven.

Here again, Gould is very clear about his intentions, but I would have liked them to have taken more note of the orchestra than they do. Both sides have an atmosphere of tension or rather determination which made me wish for more relaxation from all concerned.

I didn't feel it was necessary to drive along quite so ruthlessly to make the point.

Technically there is a clean spaciousness which is refreshing to hear. The piano is light but convincing in its sound, and the orchestra precision itself. Despite its briskness there is nothing lost which has been defined, and the very quiet surface is a big point on the credit side.

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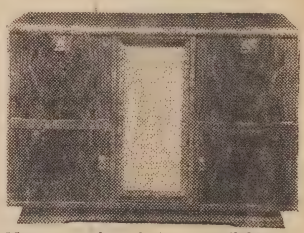

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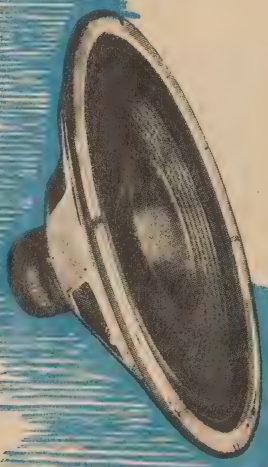

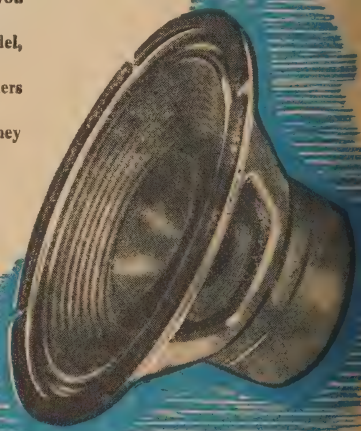

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Gigli re-created, for all his were recorded in his heyday, are most notably presented ttle modern orchestra to help

the process is very well done, there are one or two strange where the old accompaniment s through.

ttle of the old surface noise is and then in only one or two Generally the background as d by the modern part of the s is quite absent, in fact re-so.

fect is aided by the high amp- the voice which is invariably nt quality, and a big contrast i's last record made at a Car-ll concert shortly before his

the duets is there undeniable on the top notes, and these 's.

enor, the singer enjoyed fame le only with that of Caruso, n he was often compared. This t be so, for he was as much nor as Caruso was dramatic. tter had vocal and emotional very much wider in scope.

nately the absence of elect-rding prevents us from fully he difference.

probably Gigli's last bow, and one. All credit to the engineers so superbly brought him back me of his numbers, particular-e aria from Andrea Chenier, evidences of their comparative but plenty of the singer's real

n one disc are most of the enor highlights from his re-

★ ★ ★

ORCHESTRA—FULL DI-ONAL SOUND WITH WSKI. Dukas, Fanfare Peri; Barber, Adagio for Strauss, Gavotte from Suite ids, Opus 4; Farberman, 1 of Evolution; Vaughan —Scherzo from 8th Sym- Perischetti, March; Tchai- Scherzo from 4th Sym- Moussorgsky-Ravel, Select-n Pictures. Played by Sym-rchestra conducted by Sto-. Capitol SAL-8385.

has specialised in demonstra- s almost from the introduc- recording.

us who have made a hobby grew up on the original High Fidelity" which was produced to show off some ment or piece of equipment. days engineers were occu-

pied with the sheer exuberance and impact of sound. Today, when their work is on show, they like to be more subtle about it—they record music which can be listened to for itself, just to show how skilfully they can manage mike placement and balance to produce the effect they want.

This is virtually what Capitol have said in the 24-page large booklet issued with the disc, in which the music is discussed along with a number of interesting points about recording technique, microphones, etc., which all goes to make things more interesting.

And to see that all is well done they have enlisted Stokowski, still photogenically inclined, to conduct an unnamed orchestra in New York.

First impressions of the disc might be disappointing if you were expecting close recording and extreme range.

There is good range all right, but there is mostly excellent playing and sound which nearly always lives up to the rather enthusiastic programme notes.

LISTEN CAREFULLY

You can learn quite a lot from this disc about the problems facing a recording engineer. It will pay you to listen carefully to all the parts, how they are put together, how they are compared and contrasted and blended.

I though the brass and woodwinds very successful in their examples. The opening fanfare is one of the most impressive items.

The Moussorgsky "Pictures," with which the record ends, isn't better than the best competition, but it's mighty sound, and it is different because the engineers meant it to be so. That's really the most fascinating thing about various versions of such music, and the most rewarding for one who listens for hours to just about everything of note that comes out.

I mention some surface crackles mainly because such faults should not appear in a special disc, nor a slightly higher rumble level than we get from the best. Neither point is likely to mar the considerable enjoyment you will get from it.

★ ★ ★

DVORAK—Symphony No. 5 in E minor. Played by the Symphony of the Air (late N.B.C. Symphony Orchestra). World Record Club TT3.

This is, in my opinion, the most interesting and successful record yet issued by the World Record Club.

For 17 years Toscanini had directed the N.B.C. Symphony Orchestra, whose powerful work is well known to record enthusiasts over many years.

After his death the orchestra gave some concerts in New York in an effort to keep the players together, but, because of its reluctance to serve under any other leader, played without a conductor.

That this was possible at all represented the greatest possible tribute to Toscanini, for the players themselves realised that a sub-standard performance would be unthinkable.

Just how well they succeeded is eloquently demonstrated by this disc. Only a few inner passages, where the sheer sound volume must have prevented all sections from hearing each other, is there any mistiming. Elsewhere they are unanimous.

As for the performance, it has the

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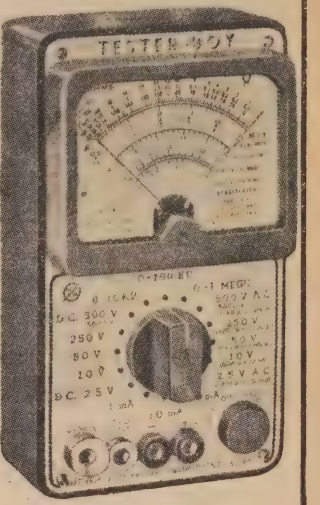

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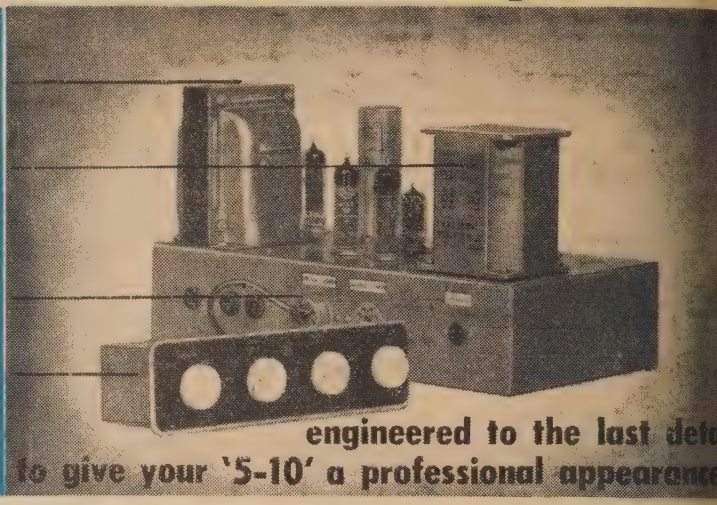

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stamp of Toscanini's drive and power. In this I am sure no sion compares with it. is little softness or glow about is slow movement. Its cleanly ne of perfection may never e to tears, but there is great its exquisite shape and line. ithout doubt a magnificent or- was a model which has had a effect on the quality of Ameri- binations ever since, but few owed it succesfully.

an actual-performance record- cks some finish, but it is far isfactory than those made in 's lifetime in Studio H. It has illiance, great dynamic range, mendous vitality which sweeps with it.

ht it one of the month's most records, not only for its music eering, but also for its historical

★ ★ ★

DELSSOHN—Concerto for and Orchestra in E minor 64.

AIKOWSKY—Concerto for and Orchestra in D major 5. Played by Zino Frances- nd the Philharmonic Sym- Orchestra of New York con- by Dimitri Mitropoulos. t KLC 638.

quite a disc, not only because ard of performance is so high ecause two of the most popu- tos are to be found on a single

rue that in the case of the ky engineers have cut danger- e to the label, and that if your harp you will notice some dif- quality at that point.

not noticeable enough to prove ntage when adding up the bill. haikowsky is just about as ersion as there is.

ier two to consider would be ch and Campoli, both single-

ner is the most perfect fiddler, ue hasn't the fire and flash of ti, something this work needs

has the most forward record- s is a highly coloured version e classic outline of the others. catti doesn't lack warmth or e sentiment, any more than he rance, and can be considered ceptable blend of the virtues. lso the only one to use the he second movement. Most efer to retain full power to ir lower strings. Francescatti's werful enough, and I thought e tone brought an unusual in- directness of appeal.

Mendelssohn is also first class. It e firmly, and never allowed to esweet. Some might even con- playing of the second move- ompromising. I don't—it's all spoil this fine concerto with , sentiment, no matter how customers like it.

t he judged pace and emo- very well.

nd is good, upper-bracket ut being stunning, and the ds against it very nicely. nother Coronet you will find resist.

BEETHOVEN — Concerto for piano and orchestra No. 2 in B flat Opus 19, and No. 3 in C minor Opus 37. Played by Freidrich Wuhrer and the Pro Musica Orchestra, Stuttgart, conducted by Walther Davissen. Vox APL 9570.

Extra long-playing discs seem certain to play a big part among records of the future, and once again Vox have done an excellent job in grouping two works on a single record.

Naturally one will ask whether quality has gone along with quantity.

I don't think either the orchestra or the soloist is as good as in the best single alternative versions, but that's not the same as saying that they are unsatisfactory here.

On the contrary the balance is well on the credit side.

Both performances move briskly, but others have followed the same pattern without the pressure of limited recording space to spur them on. But, particularly in the Third, I had the impression that neither orchestra nor pianist was prepared to waste a moment. After all, they manage the course in 32.08 minutes, and in so doing, the over-all contours were somewhat flattened.

The Second I thought more successful, but then it is shorter and not so difficult to accommodate without a turn-over.

Wuhrer is a pianist of considerable worth in the classical manner, and if he isn't very flexible he is safe and normal in his approach, despite a few moments of doubtful accuracy. The recording keeps him well forward with a piano slightly tubby in quality, rather overshadowing the orchestra which hasn't as much weight as other more famous competitors.

A few spots of groove echo are the only blemish on an otherwise very good technical job. The cutting amplitude is quite high and the surface quiet and clean.

It appeals to me as really excellent value for the money and a good quality musical disc into the bargain.

★ ★ ★

SARASATE — Navarra (Spanish Dance); WIENIAWSKI — Three Etudes from Opus 18. Played by David and Igor Oistrakh, the first item with the Gewandhaus Orchestra, Leipzig. DGG 30 286 EPL.

The association of father and son in a violinistic display on the same platform is probably unique, and certainly if we insist on a standard of playing as given by the Oistrakhs.

For Igor, overshadowed by his famous father, is no mean fiddler himself.

The display in the Spanish Dances is sheer delight, not only for the admiration such perfectly co-ordinated playing demands, but because of an exhilarating and tuneful performance.

The recording, too, is quite delightful, with plenty of lift and brightness to give the music style and finish.

The Etudes are played unaccompanied and in them there is less perfect team work although it suffers mainly by comparison.

Maybe that's another way of saying that it's only a few steps below near perfection, for without doubt it is superlative playing.

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SHORT-WAVE NOTES BY ART CUSHE

NEW FREQUENCIES FOR RADIO SARAWAK

Two new frequencies have been introduced by the Kuching station, thus giving increased service in Sarawak.

THE use by Sarawak of the new 41-metre band frequency has been widely reported by listeners, and it has been received at fair strength. The past few days, due to the early sign-on of the Voice of America station at Okinawa which also operates on 7160 Kc, has resulted in a less effective signal. Sarawak has made a change in the times of its language broadcasts, and Malay is now heard at 8.00 p.m.; English from 8.30 p.m., and the same language for the last 30 minutes of the transmission to sign-off at 12.30 a.m.

Radio Sarawak is now using a new schedule and this has been forwarded to us by Kevin Dunham, Naranda, N.S.W. Broadcasts are made on 9565 Kc from 2.00 p.m. to 3.30 p.m. daily, with the broadcast to 4.30 p.m. on Sunday. On 7160 Kc it is heard from 6.00 p.m. to 12.30 a.m. with the same program being carried on 4950 Kc.

The use of the 7160 Kc frequency by the Voice of America station at Okinawa has spoilt reception in this area, and though the Okinawa station is scheduled to open at 9.00 p.m., it has been heard earlier. Our listening has revealed the station on the frequency before 8.30 p.m., which will give little hope of the signal of the Sarawak station being heard over much distance.

Radio Sarawak was established in 1954 to provide a system of mass communication for the people of a country where communications are still slow and difficult. Sarawak broadcasts daily in English, Chinese, Malay, and Iban, this last language being that of the largest single racial group in the country, known as the Sea Dyaks.

B.B.C. news bulletins in Chinese, English and Malay are relayed daily from London.

Since the station commenced in 1954 interest has grown to the extent that well over 30,000 receivers are in use in the country. The transmitting station is located 1¼ miles from Broadcasting House, Kuching, with direct landlines to the studios. The transmitters include a Marconi 5-Kw transmitter, on 4955 Kc, while a similar station works on medium wave on 850 Kc.

RADIO NEW ZEALAND SCHEDULE

The present schedule of the broadcasts from Wellington is as follows:

TO AUSTRALIA

6.00 to 8.30 a.m. on ZL3 11780 Kc.
8.45 a.m to 4.40 p.m. on ZL14 17820 Kc.
4.55 p.m. to close down, ZL2 on 9540 Kc.

TO PACIFIC ISLANDS

3.00 a.m. to 8.30 a.m. on ZL3 11780 Kc.
8.45 a.m. to 12.45 p.m. on ZL14 17820 Kc.
1.00 to 4.40 p.m. on ZL3 11780 Kc.
4.55 p.m. to close down on ZL7 6080 Kc.

Close down times are Sunday, 8 p.m. week days, 8.45 p.m. and Saturday, 9.20 p.m.

Tokyo uses 21620 Kc.

THE first use of the 13-metre band by Radio Japan took place last month when the European service was moved to 21620 Kc, using the callsign JOB24.

The transmission, which is on the air from 4.30 to 6.30 p.m., is also released on JOA24, using 17855 Kc.

Programs consist of many European languages, with the period in English being broadcast from 5.50 p.m. to 6.15 p.m., the complete transmission being on the air from 4.30 p.m. Signals are very strong on both frequencies but the new 21620 Kc outlet has less side interference and in our area is the strongest signal on the band at the time of the English release.

English from Buenos Aires

BROADCASTS from Buenos Aires in the new International Service from the Argentine capital have been tuned on 9690 Kc.

The station in use is LRA, and the broadcasts are from 1.0 p.m. to 4.00 p.m. with sessions in several languages each hour. English news is heard at the opening of the transmission, and this is repeated each hour, as the service is directed to East Coast, U.S.A., West Coast and finally in the Pacific area.

Signals are of good strength, but after 3.00 p.m. jamming of the balance of the transmission is noted. The transmission to Europe of LRA is carried on 15345 Kc, and the broadcast consists of sessions at 5.00 a.m. in Spanish, 6.00 a.m. German, 7.00 a.m. Italian, 8.00 a.m. French, 9.00 a.m. English and Portuguese at 10.00 a.m. The station identified as R.A.E., Radio Nacional, Argentina, Buenos Aires.

New Chilean on 6095 Kc.

BROADCASTS from Chile on 6095 Kc, which we have heard to 3.00 p.m., have been identified as CE610, which is announcing as having studios in Santiago.

The station is actually assigned to 6100 Kc but appears to be operating slightly lower in frequency. Broadcasts suffer rather severe interference from Sydney station VL16 on 6090 Kc.

The station carries typical Latin musical items and closes at 3.00 p.m. with the Chilean National Anthem. Broadcasts from CE610 carry the slogan "Radio Calama." The studios are listed in Calama, though the station announces an address in Santiago when it leaves the air.

Raratonga changes sched.

THE Cook Island station, ZK1ZA, which broadcasts on 4965 Kc, has been heard on a new schedule with the usual broadcasts at 3.00 p.m. on a Thursday afternoon.

The station last winter was heard broadcasting from 2.30 to 3.15 p.m., but this season we have observed the broadcasts as being on the air from 2.00 p.m. to 3.30 p.m.

The session is in English and is mainly of request items for listeners in the Cook Island area. The station closes at 3.30 p.m. when the announcer states the station will be on the air at 6.00 p.m. the following Wednesday.

After the national anthem a sign-off announcement is made by the technician on duty, which states the station is operated by the Cook Island Administration, on 4965 Kc with the power of 500 watts.

A card from the station is received in reply to reports on reception of ZK1ZA.

NOTES from Listeners should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Time.

Costa Rican on 5980 Kc.

BROADCASTS from TIQ in Costa Rica have recently been received at surprising strength during the afternoon. Broadcasts originate from Puerto Limon, with the mailing address of Radio Casino, Apartado 287. The station has been heard with popular Spanish numbers to 2.30 p.m., followed by 30 minutes of numbers from the classics with "Largo" (Handel) as the theme tune.

The station, closing at 3.00 p.m., gives broadcast band frequency of 1175 Kc and shortwave channel of 5990 Kc, though we measure this slightly lower here and clear of OAX4V on 5990 Kc. The station uses a march theme when closing and fades this for a full announcement.

XEMQ on 6110 Kc.

A NEW signal from Mexico has been heard in the afternoons with typical Spanish programs on 6110 Kc. This one has been identified as "XEQ" and uses the slogan "La Voz de Yucatan." The program has consisted of a concert to 2.45 p.m. and then light music, including both American and Latin tunes, until the station closes after 3.00 p.m.

Broadcasts originate from the medium-wave station XEMQ on 1240 Kc, which operates with 250 watts. The station has already been reported as being verified by a listener in North America, and reports should be sent to Calle 60, No. 735, Merida, Yucatan, Mexico.

FLASHES FR EVERYWHER

RANGOON with broadcasts from again made a frequency change. closing at 1.15 a.m. on 15365 Kc, still has relays on 9640 and 7118 Kc, hour of the broadcast is in English plete transmission is from 7.30 p.m. Sudan Broadcasting Service, with the from Khartoum, verified with New Ferg. Strange, with news on a new sch is using Radio Omdurman on 5000 K Kc, with powers of 7500 w. and 50 tively, during 2.15 to 3.30 p.m. a a.m.., with extra transmission on Fri a.m., and again from 3.15 to 7.30 p. is broadcast at 2.00 a.m. for 30 minut

HAITI station 4VWI, in the networ stations headed by 4VEH, has bee 17720 Kc. It was heard at 1.30 using 17720, 9600 and 6100 Kc.

TEHERAN broadcasts from the Ira are now released on a new schedule been supplied by Cyril Anderson, of thorne, W.A. The external service is 17720, 9680 Kc, when Arabic is 5.00 a.m., Russian 5.15 a.m., Turkish a.m., German from 5.45 a.m. on Mo nesday and Friday; French at 5.45 a days, and at 6.00 a.m. the program is Radio Teheran now has nine news b day in the 31 and 75 M bands. 968 Kc, and these released at 0.30 a.m. p.m., 5.30 p.m., 7.30 p.m., 9.00 p.m., 1.30 a.m., 3.30 a.m., and 5.30 a

PORTUGUESE stations believed to in Mozambique have been heard in W tralia and as yet not fully identified tion heard on Monday to close at 5. nounces as "Radio Seelek," or simila tion, and location appears to be N A further station on 4755 Kc closes and this is understood to be a reg of the Mozambique Radio Club.

LUXEMBOURG, with its transmis 19-metre band, has been reported b Ewan, of Melbourne, with the broa 2.45 p.m., when the station was using Programs including the series "Bringin the Nations" was received at 2.50 p.m was followed at 3.35 by news in Fre

LATIN AMERICA is being well Europe, as well as in this area, wh the stations in the late afternoons listener has the best 49-metre band his location as including HJEZ, 6195 at 3.00 p.m.; HJKJ on 6162 Kc to 3.08 or as late as 3.15 p.m.; HJEX o heard at 1.45 p.m.; all these statio Colombia. Guatemalan station TGW Kc has a program in English at 1.15

CANARY ISLAND station "Radio which broadcasts from Las Palmas, h ported by a Brisbane listener on 70 station operates from 6.00 to 8.30 p.m midnight to 500 a.m. The station a on 9490 Kc and on this frequency the are from 6.00 to 8.30 p.m. and from a.m.

ANGOLA station of the Radio Clu at Bandera operates on 5024 Kc wi sign of CR6RH. The station is broad 4.15 to 5.30 p.m., 9.00 p.m. to 12.3 3.30 to 7.30 a.m. The station uses 1,000 w. A new studio and transmitt to be installed at the station and CR6 been allocated to the station.

SEOUL has made some program c It is now heard on 9638 Kc, with a French and English, from midnight t with the signal directed to South East lish programs comprise the first 30 the session. The callsign HLKS has tioned for this frequency by the stati The program of the Voice of Free been retimed and is heard from 7.30 on the outlet of 9638 Kc. This trans formerly heard one hour later, with in English.

ETHIOPIA, with its broadcasts on Ababa, has been heard in Cyprus frequency of 9608 Kc. The station is from 3.00 to 5.00 a.m., but at times jamming interference. It is heard sh 4.15 a.m. and again from 4.45 a.m. The station releases news at 4.15 a is followed by dance music till clo on Monday, when the music is of nature. Identification is given befor broadcast in English at 4.15 a.m. wh vealed that transmission is also carried metre band.

HE HAM BANDS WITH BILL MOORE

dio amateurs performed much of the pioneering work in exploring the short waves. They etured lower and lower until it was clearly demonstrated how effective world-wide com- nication was at these wave-lengths. It was this work that made a name in radio history.

llowing comment covering amateur radio ty in the 1920s and early 1930s is the s series of articles gleaned from news- tings of the period.

e initial pioneering of the short waves 25-1926, news of amateur activity was featured practically daily in the Press. nication on this part of the frequency was becoming commonplace and short- dcasting stations were opening in many e world.

lowing covers phases of amateur activity st nearly as complete for a period as in other issues.

1925, the late Chas. Maclurcan, 2CM, ertical aerial for the first time for 20- mmunication with G2OD. Results were ior to those obtained on the multi-wire d this fact was endorsed by a number tions. Low-angle radiation by accident n design.

same month Fred Schnell, W9UZ, visited He arrived with the American Fleet orld-wide shortwave communication.

Traffic Manager of the ARRL, at a ld in his honour by the WIA, stated ARRL membership at that time was ST had a circulation of 85,000 copies 4,000 W amateurs served in the forces W. Fred also described the ex- ork of the American amateur during mergencies.

CONVENTION

st Federal Convention of the WIA was erth in August, 1925. The convention sumental in bringing the divisions of the all States closer together to more effec- resent the Australian experimenter.

same month the first Tasmania-England e contact was made between J. Brooks, d Gerald Marcuse, G2NM.

ry, 1926, saw the planning of a world- ortwave test with the ARRL, RSGB and operating.

ject was to discover the longest period ay during which reliable communication e and schedules were arranged over 24 the day. English, American and Aus- tive used wave-lengths between 5 and ters.

WIA two-way reliability tests were con- n May 23 and June 6, 1926. They he effectiveness of shortwave communi- r Trans-Pacific working; 53,000 words of st messages were handled.

seven Australian stations participated and ng amateur out here was A7DX, the late Watkins, of Hobart.

permission was granted in 1926 for so be broadcast from 2WI weekly. They ce on subjects of interest to experimenters. cond Federal Convention of the WIA was held in N.S.W. in September, 1926. The Lord Mayor of Sydney accorded a civic reception to the delegates.

A scheme was presented in August, 1927, by the WIA to the Federal Government for the setting up of an amateur relay organisation to handle unimportant messages. The scheme to be conducted by the council of the WIA would be run on simliar lines to the ARRL organisation. The statement was to the effect that the plan was supported by Federal Ministers, the Postmaster-General and officers of the Post Office.

The amateur bands as we now know them were first introduced in January, 1929. The bands available were as follows: 5.0 to 5.35 metres, 10.0 to 10.7 metres, 20.8 to 21.4 metres, 41.0 to 42.8 metres, 150.8 to 175 metres, and 175 to 250 metres.

"These bands will only be available for amateurs for the present and it will probably be found necessary to rearrange them in 12 months' time.

"Transmissions on these wave-lengths must be confined to experiments and tests but the department has decided to permit the exchange between amateurs of messages relating to the experiments. In no circumstances can messages for a third party be transmitted without the permission of the department.

"Callsigns for experimental stations will in future be prefixed with the letters VK instead of OA."

Some of the feats of radio amateurs in emergency were recorded in these cuttings. Among them was the work of Don Knock, VK2NO, who delivered to naval authorities a message from an Australian cruiser. At the time of a disturbance in the Solomons, the cruiser was unable to contact the Naval Depot at Sydney direct and communication was established via amateur radio.

During floods in Queensland in 1928, VK4NA and VK4BW handled traffic for over 48 hours and finally passed their stations over to P.M.G. operators.

In April, 1929, during floods in Tasmania, VK7DX and Ray Jones, VK3RJ handled 11,000 words of traffic for the P.M.G.

During an interruption in the transcontinental telegraph in November, 1930, Harry Caldecott, VK2DA, and Roy Hart, VK2HO, handled considerable telegraph traffic with VK6BO.

In March, 1931, when the "Southern Cloud" was lost, amateurs throughout the country were alerted to listen out for the plane.

When the late "Dave" Smith attempted to fly to England and was forced down near Wyndham, VK6NK and Jack Pike, VK2JP, relayed messages to the aviation authorities.

Early in 1931, New Zealand radio amateurs played an important part in providing communication during the Napier earthquake disaster.

All other means of communication failed and in some cases Government authorities took over stations of amateurs temporarily.

INTERFERENCE MAY POPULARISE SSB

NSIDERABLE amount of publicity has e given to the correct usage of the vari- ateur frequency assignments in overseas

roblem of interference (by amateur sta- used by band congestion is not so pro- e here as in other countries. In some ties it reaches fairly high levels at times. s of the 14 Mc band for cross-town work- ng DX openings is one point that is spoken and written about.

l a considerable amount of the net work- .5 and 7 Mc bands could be well trans- the VHF bands, it is really only on HF bands that there is any surplus space dional stations.

ain point made in the publicity is for ading from the HFs to these bands as eir population increases.

e publicity is also being given to the SSB as a means of combatting QRM ony sections of the HF bands.

mateurs have even suggested that single e be used exclusively on the DX com- an bands and that the double side-band emission be banned from these assign-

re is no doubt that the amateur service in e will have to consider conservation of use and that some of the above ideas to be implemented.

The I.T.U. Conference will see the various services clamouring for additional frequencies.

Any suggestion for improving amateur usage of their available frequencies will have to be seriously considered.

New Amateur Prefixes

WITH the phenomenal growth of the amateur population, new arrangements have been made for the issuing of additional prefixes. W, K and WN calls are running out.

When these prefixes are exhausted, new amateurs other than novices will receive a WA prefix. The sixth and second districts, it is anticipated, will be the first areas to use the new identification. WV will signify a novice operator under the new arrangement on the completion of available WN prefixes.

Callsigns with a two-letter prefix and two-letter suffix will not be assigned to amateur stations located in continental U.S.A.

The FCC will as far as possible reassign calls if available to previous holders. Special callsigns will be granted for national events.

As at present, novices qualifying for a higher class of licence will hold the same suffix letters and only the prefix will be varied.

NEWS ON DX BANDS

ACCORDING to DX authorities, the VQ8 prefix position will be clarified and the callsign allocated will indicate the islands on which the station is located. Amateurs on Mauritius will use their normal two-letter suffix, say, VQ8XX. On Agalega the call would be VQ8XXA, on the St. Brandon group VQ8XXB, on Chagos VQ8XXC, and on the Rodrigues VQ8XXR. This new arrangement by the Mauritius Telecommunications Department will greatly assist DX operators.

Jan. OK1JX, who is conducting Ludvik JT1AA and Mila JT1YL QSL affairs, finds little time for his normal amateur activity. To date Mila's QSL cards are not available but should arrive in early July. Both of them will stay a little longer in Mongolia than anticipated and so extend the chances of a contact with Zone 23. Before they leave they hope to encourage further amateur activity in the area.

Many amateurs throughout the world have been able to realise their ambition to win a WAZ award and the JT1 DX-pedition has proved one of the most useful yet organised.

New countries

LATEST addition to the official countries list, Lord Howe Island should prove an easy one for VKs. Allan Smith, VK2AIR, will soon be operating from there for a period. Contacts after November 15, 1945, will count after July 2, 1958, for DXCC purposes. In view of this addition and the fact that Tasmania at least has its own State Parliament, the VK7s must soon become among the DX elite.

DX on 50 Mcs has been quiet from Australia in the last month but more and more overseas stations are becoming active on these frequencies.

During the peak W to VK and ZL workings in March and April, from reports some 81 W stations contacted New Zealand on 15 days in March and 10 in April. New prefixes on the band included VP5, FS7, VU2, 4X4, ZS3, ZS9 and SM/LA. Spitzbergen.

DX Operating

TAIL ending is a DX operating habit condemned by many operators. Stewart Fason, SVWQ, during his DX-pedition to Crete, however, praised the method and used it extensively. He said it is by far the fastest way invented to work stations.

Stewart heard the best DX men in the world using the practice and recommends the following procedure.

Do not zero the station being worked but move either way a few hundred cycles. Wait until the station being worked has sent the report and then sign your own call no more than twice. Send it slowly at about 10 WPM, no faster, and await results.

Tail ending has come to stay as an operating procedure and the DX fraternity will have to make the most of it.

LICENCES IN U.K.

PREWAR amateurs, who have let their licences lapse in the U.K., will, under new regulations gazetted, be required to pass both the Radio Amateurs' Examination and Post Office Morse Test before being allowed to operate again.

Postwar amateurs who have passed both examinations can reapply for licences. If they are not qualified to these requirements, applicants will have to pass the test or tests before being granted a licence.

Postwar, a number of licences were granted to ex-servicemen without examination.

In any case if the licence was cancelled over 12 months ago the applicant will again be required to pass the P.O. Morse Test.

Novice Activity

AMERICAN novices are particularly keen to contact VK stations on the 21 Mcs band. They are all newcomers to the game and only hold a licence for a year unless they qualify for a higher class.

Permitted to operate CW on small segments of 3.5, 7 and 21 Mcs bands, most of their DX operation is in the 150 Kcs assigned in the latter band.

Some of the novices are competent Morse operators but it is necessary to drop below 10 WPM in most cases.

An hour spent in their segment will provide a thrill for many a novice, often it is their first DX.

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Chandlers Pty. Ltd. Cnr. Albert and Charlotte Streets.
Trackson Bros. Pty. Ltd., 157-159 Elizabeth St.
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SYDNEY:
Audio Engineers Pty. Ltd. (N.S.W. Distributors to the Trade), 422-424 Kent Street.
United Radio Distributors, 175 Philip Street.
Modular Electronics, 579 Sydney Rd., Seaforth.
Magnet Sound Industries, 387 George Street.

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L. S. Wise Ltd., 196 Gilles Street.
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TASMANIA:
HOBART: Homecrafts (Tas.) Pty., Ltd. 220 Elizabeth Street.
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AOCP Classes

S.W. Division's AOCP classes will com- on July 2 at the Railway Institute, 1 Street, Sydney. Lectures will be con- Wednesday and Thursday evenings, g at 8 p.m. The class will comprise rs, the largest enrolled to date.

WICEN practices have been conducted mornings on 7 Mc and each Tues- p.m. on 3525 Kcs. State Emergency or Bob Godsall, VK2ARG, has been in

stations in many areas have been he practices

e use has been made of 144 Mc links ountry stations and these signals have ed on the 3.5 Mcs net frequency, allow- HF stations to participate.

all, VK2JC, is the new net control Area 2; vice Jack Hill, VK2ADT, re-

y meeting of the N.S.W. Division of was devoted entirely to business mat-

esult of favourable comment it was proceed immediately with the pre- f the AOCP correspondence course. quiries regarding the course have been rom all parts of the Commonwealth. should commence on schedule in July.

2WI Dural installation was discussed and it was decided to proceed with ojects. Assistance to carry out the ork was requested..

following Sunday over 50 amateurs and including groups from the VHF and ons, arrived to lend a hand.

rays were taken down and serviced, ble was run out underground to feed 3.5 Mcs antennas. Modifications on s transmitter were also carried out. .W. Council was particularly gratified ponse to the request for assistance at

cott, VK3AFJ, Technical Editor of the nal, "Amateur Radio," appealed for rticles during his trip to N.S.W. and were promised. Work on the pro- the magazine is on a voluntary basis ce from amateurs is required to make most effective.

ams Cup is presented each year to of the best technical articles from

holder of the cup is Hans Ruckert, The Federal Executive of the WIA an award each year.

Mobile Fox Hunt

turnal "Mobile Fox Hunt" of the HF and TV section, held late in May, a win for Dave Andrews, VK2AWZ, d three points for locating the fox on un. Jim Cummings, VK2PM, gained for a second-run find, and Phil Pear- BB, one point on the third run. Eight ticipated in the hunt.

on has decided to classify their trans- s to avoid any confusion. When the he move they will be called a "Mobile If the fox is at a fixed location, will be classified as a "Hidden Trans- t."

section of the N.S.W. Division meet- on the second Friday of each month ilway Institute, Sydney. Lecturer at eeting was Norm Burton, his subject, "

n January of this year, the Blue Moun- Club was an unusual organisation, no office-bearers, no constitution and re paid, an ideal arrangement to re- ossibility of argument, except on tech- rs.

ngement, however, was short-lived as e club became the Blue Mountains the WIA, N.S.W. Division, with the ffice-bearers: President, Wal Cromie, easurer, Norm Durham, VK2QA; pub- r, Bob Lear, VK2ASZ. The section he third Friday of each month at the ll, Springwood. Intending amateurs or invited to attend.

TU Conference

ATION for the 1959 Geneva Adminis- Radio Conference is proceeding and dministrations have been requested to r proposals to Geneva not later than 58. The volume containing all pro- be returned to all administrations by 1959.

er of amateur national societies have ir intention of providing representation for the conference.

B have informed the IARU Region ey will nominate a representative. osal of the WIA to afford represen- Region 111 has been the subject of sted to all Australian radio amateurs. ill appreciate the necessity of taking ution to ensure effective representation ortant meeting.

s toward the cost of sending a delegate directed as requested.

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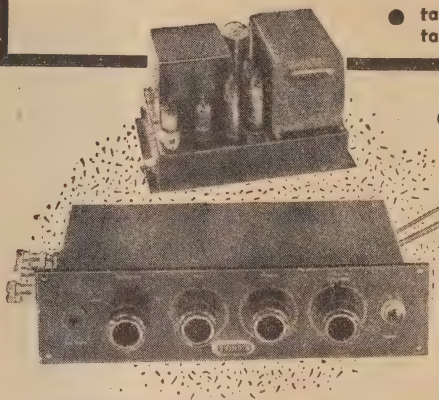

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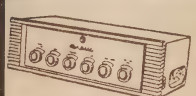

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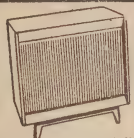
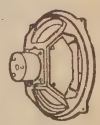
Altec and Wharfedale corner enclosures. £42/10/-



Enclosure Kits fully assembled ready for painting or polishing. £15/15/-



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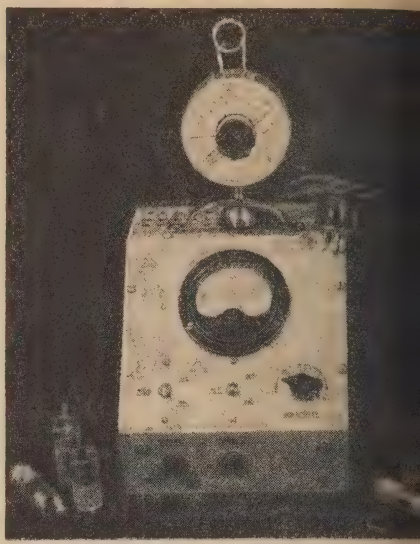
A READER BUILT IT

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A reader from Parkdale, Victoria, Mr W. T. Lucas, has constructed an advanced grid-dip oscillator and submits both photographs and a circuit of the instrument. It covers a very wide frequency range and will be extremely useful in all equipment using high frequency tuned circuits. Radio amateurs particularly find a grid-dip oscillator almost essential in the adjustment of multi-band high frequency transmitters.



Right: The grid-dip oscillator unit includes the indicator unit and power supply in a sloping panel cabinet, the RF head and six coils. The "coil" for the highest frequency band is actually a strap with a half turn.

☆

Below: The picture inside the RF head shows the modified tuning capacitor and the special coil socket.

The basic idea of the instrument is that a variable frequency oscillator which can be coupled into resonant circuits. As the frequency of the oscillator is varied over the frequency of a tuned circuit to which it is coupled, the grid current will dip, indicating that energy is being absorbed.

If the two circuits are loosely coupled and a sensitive indicator of grid current change used, quite accurate measurements of the resonant frequencies of tuned circuits are possible.

VALVE EXPERIMENTS

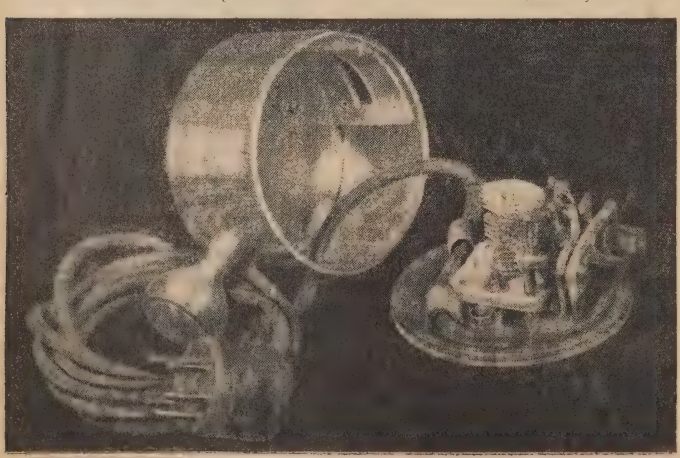
Mr Lucas writes: "I recently completed a grid-dip meter to replace an older model with an inadequate frequency coverage. To be worthwhile I expected coverage down to at least 1 metre with a possibility of 400 Mc. Experiment proved that conventional mounting of available tubes — 6J5, RL18 etc was unsatisfactory due to lead inductance. One meter of American origin exceeds 400 Mc but with the valve socket moulded into a special capacitor.

"This being impractical, I resorted to wiring the tube directly into circuit. The 6J5 was satisfactory but went gassy after a couple of modifications. Finally, I was donated a 5703 pencil triode which could stand up to the heat and gives excellent performance.

"The oscillator circuit requires no explanation except that the 5703 is a pencil triode which I think would oscillate at least to 600 Mc and is ideal for direct connection to the circuit. I found this the best tube among those I tried, but an RL18 would probably work out okay in the present layout. When I tried the RL18 the set-up was different.

"The condenser is an Eddystone 100 pF linear frequency type and i rently available. I tried other typ a miniature two gang but it w robust enough. I favour the prese since it is very strong and gives characteristic.

"The centre rotor plate is re and the two centre plates of the The two sections of the stator a carefully removed from the sup post on opposite sides, giving in a two section linear frequency tor. The capacity is modified t 20 pF giving a 2 to 1 frequency age on all but the lowest rang lower frequency limit is about 2 The upper calibration point is 3

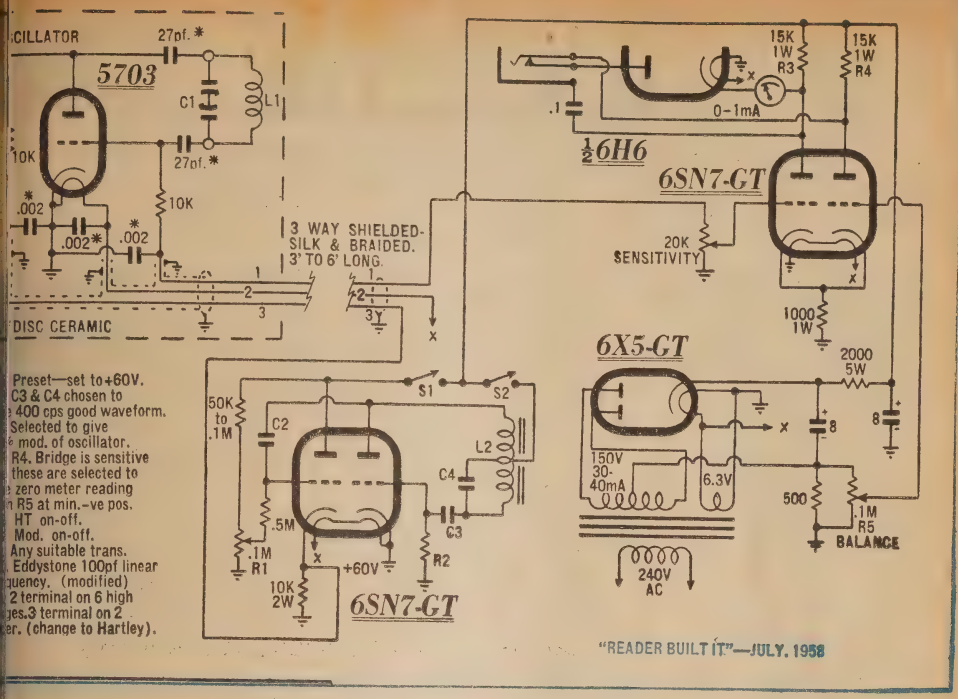


THE RF HEAD

"The case is made from 3½in f per tube turned down to a lit than 1-16in wall. The ends are plated. In my case they are 3/32 but could be lighter. The case is deep inside. Brass would be be round and could be of much gauge but I had the copper av Even aluminium would be suitab would be much lighter again.

"The back of the case is s in place while the front is tur fit snugly into place and is held b 10 BA screws. I had it silverpla

"The capacitor is centrally m on the front plate by spacers and bolts. The shaft is cleared by hole in the plate and is, of floating above earth. I think the will show the general arrangem



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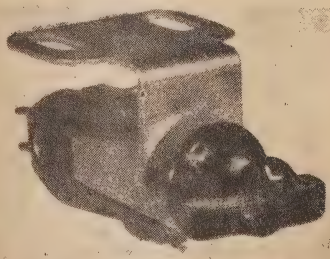

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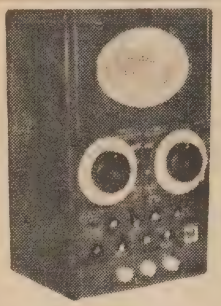

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Throat Mikes, New 3/6

12v. 420 watt Prefocus Globes 7/6

NEW C.R.O. TUBES

Suitable for TV Pic. Tubes.

VCR 139A 2¾in £1 10 0

VCR 138A 3in £1 7 6

VCR 97 6in £2 17 6

VCR 131 12in £4 10 0

70P7 7in £1 10 0

5BP1 Delivery Aug. 5in. £1 17 6

913 " " 11in

Min. CRO £1 12 6

5FP7 Flying Spot 5in £1 17 6

CV112 .. .. £1 5 0

NEW 3BZ TRANSMITTERS

12v. operation. 2 to 10 Megs.

Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services.

COMPLETE WITH 1 CRYSTAL.

£32/10/

TRANSCEIVERS

No. 11 less valves and meter. £3/-/-

No. 11 including valves and meter £4/10/-

No. 19 less valves and meter. £3/-/-

No. 19 including 15 octal valves and 500 micro amp. meter .. £5/15/-

N.B.: All these units are in excellent condition. For original use parts or conversion.

TELEPHONE HAND GENERATORS (NEW)

7/6 Postage 2/6.

NEW GAS FILLED VIBRATORS

12-volt.

Heavy-duty. Synchronous. Suitable to 400v. 150 Ma.

£1/-/- Postage 2/-.

AR8-AT5—COMPLETE STATION

AIR TESTED

Transmitter-Receiver. Aerial Couple Cables, Plugs, Phones, Mike. 1 Crystal to desired Frequency. 24v. Power Supply and Circuits of 2 units.

GUARANTEED IN PERFECT ORDER.

£62/10/

Other voltages available.

12V Lighting Plants

Johnston 300 watt direct coupled in 1 H.P. petrol engine. Tested. Perfect order.

£36.

NEW VALVES

217C	10/	VT502	12/6
12C8	12/6	AV11	3/9
6J8	17/6	83A	£3
VT501	12/6	6K7	5/
2D21	15/	12SJ7	12/6
6L6	20/	12SK7	5/
1C6	12/6	12SL7	12/6
1J6	12/6	39/44	10/
1P5	2/6	46	12/6
6A6	12/6	47	12/6
3A4	15/	78	12/6
3B7	10/	828	£2/10/
3D6	10/	843	£1/10/
6AG5	7/6	957	10/6
6AM5	15/6	1625	£1
6AM6	17/6	1629	10/
6H6	2/6	4307A	10/
6J6	15/	1619	£1
617G	7/6	2050	£1
6N7	10/	9001	8/6
10	15/	RK75	10/
12A6	2/6	VR75/30	15/
2A3	£1	RK48A	£3
KTW62/6U7	7/6	954	7/6
		VR105/30	15/
1M5	7/6	1C7	2/
1D5	7/6	1A5	7/6
CV6	3/6	7193	3/6
6F6	12/6	829B	£3
VR65A/SP41	2/6	6G8	15/
		6B8	12/6
KT66	27/6	807	15/
806	£3/10/	EL.NG	12/6
1K7	7/6	83	10/
6X5	10/	EM1	12/6
6V6	12/6	866A	15/
1Q5	2/6	6AC7	2/6
811	10/	EF50	2/
6B5	12/6	1000TH	10/
6BM8	17/6	5R4GY	£1
12K8	12/6	6AJ5	9/6
1T4	10/	EA50	2/6
1R5	10/	1K5	2/6
3S4	10/	5Y3	12/6
1L4	5/	6C4	7/6

NEW AIRCRAFT AIR COMPRESSORS

Complete with Filter. Hi-speed. Ball bearing. 2 cu. ft. per minute. Ideal for small spray gun, etc.

£3/17/6

New Microswitches 6/6 each

Postage 6d.

WALKIE TALKIE

American No. 536 Transceivers. Complete with Valves.

£6/17/6

NEW TRANSFORMERS FEGUSON VIBRATOR TRANSFORMERS

300 x 300 100 6v. £1 17 6

325 x 325 125 12v. £3 12 6

Inverter Transformers

6v., 240v. 40 watt £3 7 6

12v., 240v. 60 watt £3 7 6

32v., 240v. 60 watt £3 7 6

C.R.O. Transformers

350 x 350 extended to 1000v. 6.3v., 6.3v., 215v., 4v. .. £4/5/-

Postage: N.S.W., 5/; Interstate, 7/6.

Power Transformers

240v. A.C.

285 x 285 60mA £1 17 6

285 x 285 80mA £2 7 6

285 x 285 125mA £3 5 0

TV Power Transformers

295 x 295 300mA £6 15 0

295 x 295 400mA

12 amp Fils £8 5 0

RELAYS

6v. 3-Pole Miniature 15/-

1700 SPDT 7/6

1300 SPDT 7/6

500 x 500 SPDT 7/6

12 volts DPDT 5 amp. .. £1/-/-

12 volts DPDT 12/6

8-16 volts DPDT 12/6

11 volt A.C. £1/-/-

Hi-speed Polarised relay, £2/10/-

400 ohm 12/6

1300 ohm DPDT 15/-

½in Square Section DURAL TUBING UP 24 12ft lengths, 1/- per ft.

Hi-lo Phono Transformers .. 4/6

Spirit Level Bubbles, mounted, 4/6

Canadian Signal Lamps 7/6

Hi-voltage Lead-thru Insulators, 1/6 each; 15/ doz.

Hydrometers, Battery Testers .. 5/9

Torches, 2-cell, Focusing .. 5/9

Multi-Strand 4-core Cable, yard, 1/-; 100 yards £2/17/6

Tx Var. Condensers, 300 pf, £1/5/-

100 pf. £1/1/-

60 pf with Vernier £1/1/-

30 pf 10/

INDICATOR UNITS for that C.R.O. project

Cabinet. CRO tube. 2¾in Acrio. Socket. Mount. Shield and Graticule

£1/7/6

NEW HMV PICKUPS MAGNETIC

£1/2/6

NEW Indicator Unit

for that C.R.O. Project. 3 valves. VCR139A CR Tube. Cabinet. Socket Mount for Tube Pots, etc.

£3/10/-

NEW HIGH IMPEDANCE HEADPHONES

£1/10/

Postage 2/6.

New Smith Aircra CLOCKS

8-day movement. Cost Govt. 2¼in £4

2¾in with sweep hand .. £5

New Coils and Intermediates Standard or miniatu to suit all valves

Coils B/C 455 KC .. .. .

Coils S/W 455 KC .. .. .

Inters .. ..

Loop aerial coils .. .. .

Slug tuned H.F. coils to suit meg. .. ..

GENEMOTORS

Input.	Output.	
24v.	250v. 100mA	£1
24v.	550v. 375mA	£2
24v.	250v. 60mA	£1
12v.	500v. 350mA	£3
12v.	1200v. 200mA	£6
6v.	500v. 150mA	£6
24v.	250v. 100mA. New	£2
12v.	235v. 50mA	£2
12v.	350v. 50mA	£2

I.F.F. UNITS

11 Valve Genemotor Powere Excellent for Parts.

£2/15/

TELEPHONES

Standard P.M.G. Type. Pedestal Magneto Phones. Tested perfect order.

£6/10/

RECORDING TAPE

E.M.I. Hi Coercivity Tape Ex-A.B.C.

3250ft Platters £2 10

2200ft Platters £1 1

1200ft Spools £1

600ft Spools 1

TRANSCEIVERS.

No. 22. Complete with Va Power Supply, Mike, Phones, and Cables.

The addition of Crystals and set conforms with P.M.G. re ments for small ships, bushi brigades.

£12/17/6

WANTED

Communications Receivers. T Equipment, P.A. Gear. Large small surplus stock. Best pric Call, write or phone any fin

Oil-filled Condense

1UF 600V 6/6 5UF 2.5V

4UF 750V 12/6 5UF 400V

10MFS 500 7.5UF 330V AC

COMMAND RECEIVERS

and Transmitters Complete with Valves.

£3/17/6 each

No. 128 Transceiv

New Condition. Complete with Valves.

£7/17/6

NEW 12V Genemot

550v. 350mA £8

250v. 100mA £2

A.C.E. (Amplification Communication Electronics)

RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N.S.W
AND 636 KING STREET, NEWTOWN. LA7008

VENINGS and WEEKENDS "KAULA," HILMA ST., COLLAROY PLATEAU — XW5956.
DULWICH HILL, UNDERCLIFFE, EARLWOOD, BUS AT DOOR, STOP No. 42.

THE UTSTANDING -VALVE HI-FI

DIOGRAM CHASSIS

porating Mullard 5/10 bass amplifier, treble boost dual tuned R.F. stage. Built-in pre-ier for microphone or tape re- including Jensen twin speaker,

£44/15/-

THE FINEST SET AT ANY PRICE

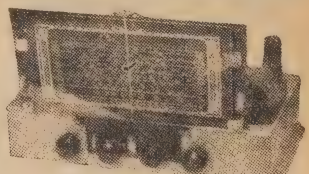
CHECK THESE EXTRA FACILITIES

Built-in Pre-amplifier to suit crystal microphone tape deck, electronic guitar, sound on film TV, etc. Hear it demonstrated on these units.

EVERY SUNDAY 2 to 5 pm DEMONSTRATIONS

OR EVENINGS BY PHONE APPOINTMENT AT COLLAROY PHONE XW5956

CABINETS AND ALL ACCESSORIES TO SUIT



Dual wave, 6 valve radiogram chassis includes bass and treble boost. 12in Jensen or Magnavox speaker,

£23/15/-

8 VALVE RADIOGRAM HI-FI CHASSIS

Dual wave, bass and treble boost tuned R.F. stage, 12in speaker,

£28/17/6

AMPLIFIERS

IBLIC ADDRESS ANGE 240-AC

ve 10 watt .. £14/17/6
e 25 watt .. £25/7/6
e 40 watt .. £32/7/6

ATTERY ONLY OPERATION

ve 6v 10w £18/15/0
ve 12v 10w £19/15/0
ve 12v 25w £24/17/6

TERY AND A.C. OPERATION

ve 10w 6v £20/15/0
ve 12w 12v £21/15/0
ve 25w 12v £29/7/6

HI-FI RANGE MULLARD 5/10

£28/15/

sson O.P. transformer. nd U.L. taps.

ULLARD 5/20 as above,

£36/15/

i separate Control Box nd Mike. Pre Amp.

£6 extra

ders to your choice extra if required.

CHASSIS FOR V OR 21in TV

nplete with EHT Box and cets £3/12/6
ais for 5in .. £1/17/6

TV

R. TV & H. KITS

Complete Kits

17in with wired and tested Steanes Strip and Philips Turret.

£108

21in as above £118

P.A. SPEAKERS P.A.7 UNITS

£10/10/

Rola 10in Permag Speakers in Box. Baffles with multi match transformers.

Slightly used £2/10/ ea.

STRIPS & COILS

Steanes Pre-aligned

Mark 1 .. .. £20
Mark 2 with limiter .. £23
Mark 3 for 6AC7 .. £20

STEANES KIT OF COILS

For Mark 1 and 3 with chassis sockets and Circuit Diagram £6/10/0
Mark 2 .. .. .. £7/7/0

RCS STRIP KIT

For 17in or 21in .. £7/5/0
For 5in £6/17/6

R. TV & H. 21" TV CHASSIS

Now on display at Newtown and Collaroy.

SEE IT IN OPERATION

The complete kit of parts including wired and tested Steanes of R.C.S. I.F. Strip and Philips Turret Tuner.

£118

Console or TV Gram Cabinets to suit.
Set can be supplied wired and tested.

NEW ALTEC LANSING CELLULAR H.F. THEATRE HORNS, £15

SKYLINE ANTENNAES

A complete range of Antennaes to suit all areas from

£5/5/

Special Price or Trade Quantities,

For all your TV needs. Better Service. Lower Prices and Practical Advice and Assistance, contact A.C.E. any hour.

4 SPEED PLAYERS £11/17/6

4 SPEED CHANGERS £14/17/6

5 VALVE RADIOGRAM CHASSIS

DUAL WAVE 12in SPEAKER

£18/15/-

5 valve also available as home constructor's Kit Sets.

Complete with circuit.

£14/15/-

7 VALVE DX RECEIVER

3 band, 2 to 6 to 18 megs 160 to 16 metres and broadcast. Exceptional selectivity, sensitivity 2 microvolts. New Australians, listen to European short-wave stations.

£29/17/6

ALUMINIUM CUT TO SIZE

16 Gauge 6/ sq. ft.
18 Gauge 5/ sq ft.

COLLARO TAPE DECK

With 5-Valve, Amplifier, Speaker. Crystal. Mike.

£62/15/-

With Built-in Tuner Amplifier,

£78/-/-

Only the Cabinet required for HI-FI Tape Recorder.

A.C.E. Amplification Communication Electronics

RADIO

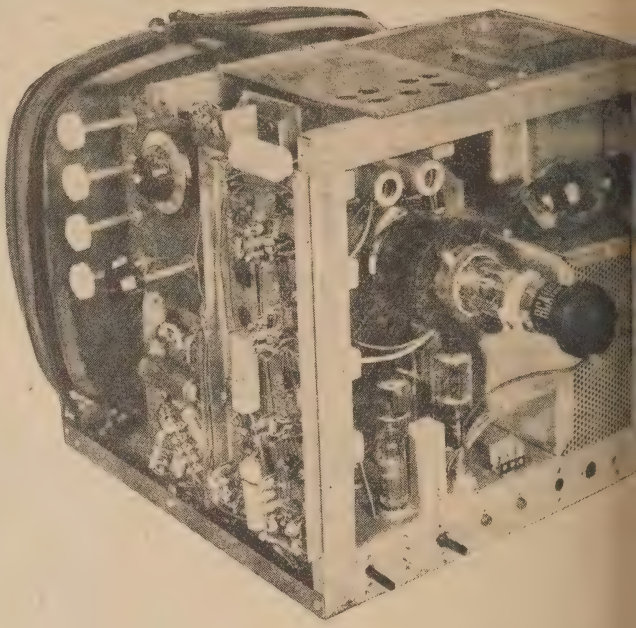
PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

NOW AVAILABLE

Q.+.T.V. KIT

Build it yourself. No Test Equipment is necessary



COMPLETE TO THE LAST NUT AND BOLT, INCLUDING ILLUSTRATED CONSTRUCTIONAL MANUAL AND CIRCUIT.

The tuner and strip is wired, aligned and airtested.

ASSISTANCE TO BUILD IT.

You can arrange to build it at night or weekend in our Newtown workshop, using our equipment, under our supervision.

SUCCESS IS GUARANTEED.

COMPLETE KIT INCLUDING 19 VALVES AND PICTURE TUBE.

£120/-/-

Wired and Tested, £12 extra.

Special Q.+. Cabinet to suit set available shortly, priced at £9/10/-.

SEE THE COMPLETED SET OPERATING AT OUR NEWTOWN BRANCH DAILY. EVENINGS AND WEEKENDS BY PHONE APPOINTMENT

ACE RADIO, 636 KING STREET, ST. PETERS. Ph.: LA700

T.V. Kit Sets

R. T. & H. MAY 58 21"

THE COMPLETE KIT SET

£118

Wired and tested -- -- £140

A.C.E. Kit set

21" -- -- -- -- -- -- £110

17" -- -- -- -- -- -- £105

14" -- -- -- -- -- -- £101

24" DeLuxe £125

T. V.

All Popular Makes All Models

Delivered to your home in original factory cartons.

Completely installed and Fully Guaranteed.

Trade in

Your present Mantle, Console or Radiogram. £30 to £75 allowed.

Turret Tuners

STEANES, PHILIPS, A.W. MULLARD, ASTOR

From

£15

I.F. Strips

Complete with valves aligned and airtested.

Your pick of Steanes, R.C. Mahood coils.

From £12/10/

ANTENNAE

A COMPLETE RANGE. PRICE FROM £5/5/0

DJUSTING YOUR 1958 TV SET

(Continued from page 75)

lar to the 3-stage 6BX6 type
ioned, showing the desirability
control of the tuner in strong
as.

ingly, we wired in an extra
n diode as AGC rectifier, fol-
e same procedure as for the
the main circuit diagram in our
e. Care was taken, however,
active leads short, minimising
of extra components and wiring
l wtih the active video detector

ght additional capacitance in-
was offset by unscrewing the
of the IF winding by about

cted, the additional diode gave
trol voltage for the tuner re-
the particular instance, a 1
resistor from the tuner AGC
o give a better overall balance
trol circuits. The modification
aple and can be recommended
where overload troubles have
untered, using this strip.

UPLING?

il word concerns the matter of
ng or restoration, as opposed
ple AC coupling employed in
il circuit.

ject has been discussed else-
need hardly be enlarged upon
sufficient to say that AC coup-
is for overall circuit simplicity
makes a receiver rather easier
in that average picture bright-
rgely independent of tuning,
djustment and tardy monitor-
station for picture illumina-

disadvantage of AC coupling
tends also to average out de-
anges in screen illumination,
being particularly noticeable
ency for predominantly black
become merely dark grey.
the screen black out between
scene.

here are difficulties in con-
receiver to DC coupling, an
effect can be obtained very
the restoration or compensa-
shown herewith.

olves using an additional gen-
le triode (e.g. a triode-con-
/6) to vary the grid voltage on
tube sufficient to offset the
hode voltage, due to the AC

ITICAL

tal circuitry is very simple and,
valve handles only very low
components, its placement in
is not at all critical. We
unted the valve for checking
a vacant socket hole in the
though it could be installed
ully alongside the synch. sepa-
n front of the sound trap.

of the compensating valve
proportion of the voltage
in the grid circuit of the
rator and this serves to vary
irrent.

is fed from B-plus through
resistor, and provides the re-
for the grid circuit of the

picture tube. The principle of operation is as follows:—

With pictures of average overall brightness, the grid assumes an average positive potential with respect to earth, the cathode being adjusted to a somewhat higher positive potential by the Brightness control, according to the user's requirements.

If the picture now changes to a predominantly dark scene, the difference between the average video level and the synch pulse level diminishes and the synch. separator grid develops a smaller standing negative voltage in clamping the pulse peaks to zero.

As a result, less negative voltage is applied to the grid of the compensating valve, which, therefore, draws higher plate current. The plate voltage falls, making the picture tube grid less positive (i.e., more negative with respect to its cathode). Picture brightness is, therefore, reduced.

WHITE PICTURE

Conversely, a predominantly white picture increases the developed negative voltage at the separator grid, and, therefore, the compensating tube grid, decreasing plate current and raising the picture tube grid toward its cathode potential, thereby increasing picture brightness.

The degree of compensation available by this method can be varied from nil as with the grid at earth potential, to gross over-control as the grid is fed with an increasing proportion of the separator grid potential.

In the prototype receiver, the suggested resistor combination gave adequate control, while the bypass was sufficient to eliminate short-term brightness variations as, for example, to cause picture smear.

Raising the picture tube grid above earth means that the cathode has to be raised an equivalent amount to preserve the action of the Brightness control. This can be done by reducing the resistor in series with the Brightness control to not less than 0.1 meg.

If this order of reduction is not sufficient to control brightness, a resistor should be added between the end of the control and earth to centralise its control range more effectively.

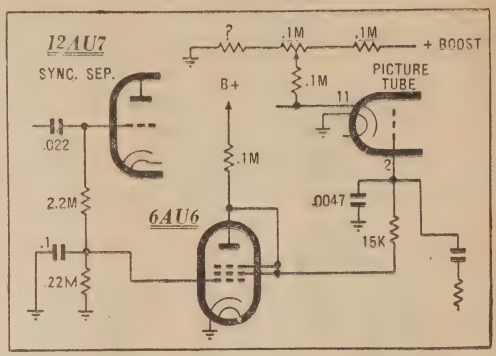
We have not had opportunity to do any lengthy work with the circuit arrangement, but it should operate with almost any medium-mu triode. The idea is so simple that readers keen to experiment should be able to make any necessary adjustment.

We would like to know your reactions to the circuit, and its operation in practice.

☆

For those who like to experiment, here is a simple method of obtaining DC compensation in the 1958 TV Receiver. Varying the value of the 0.22 meg. resistor will vary the degree of compensation. The idea would be equally applicable to the earlier circuits.

☆



ERRATA

1958 TELEVISION RECEIVER, Page 57, May Issue: Several readers have advised us that the decimal point is missing from the plate load resistor of the 6BM8 audio triode in their copy of the circuit. The resistor should be 0.1 meg.

TRANSISTOR INTERCOM. AMPLIFIER Page 33, June Issue: The symbols for emitter and collector of the lower 2N185 transistor are reversed. The emitter of the lower transistor should be connected directly to the emitter of the upper 2N185. Prolonged operation with the wrong connection will damage the transistor.

COILS FOR BATTERY CONVERTER

(Continued from page 63)

When using the generator always check to see that the image can be detected higher in the frequency than the signal itself. If the image (not a harmonic) should show up on the low frequency side, your adjustments have become confused.

With the receiver properly adjusted and connected, plenty of stations should be audible along the band. A makeshift aerial will do but, for maximum performance, a good aerial is desirable. A good noise-reducing aerial such as we have described in the past may be employed to advantage in poor locations.

Most of the important broadcasts are sent out on more than one band, but the best band is something which varies with the time of the year and the time of the night or day. Shortwave stations are aware of this and shift their transmissions from one band to another in order to obtain the best coverage.

Because most of them use directional aerials and high power, you will naturally get the strongest signals from the band upon which the station is sending its program for this part of the world.

TRANSCEIVER SPECIALS

No. 22 TRANSCEIVERS

The 22 transceiver covers a frequency of 2 to 8 Mcs, and has been approved by the P.M.G. for use on fishing boats, small craft, bush fire brigades, etc., if converted to crystal control, for which it is easily adapted. These sets are supplied complete with valves, 12v. vibrator, power supply, dynamic headphones and microphone leads.

£12/17/6 F.O.R. PACKAGE 15/- EXTRA.

No. 19 TRANSCEIVERS

These units cover a frequency of 2 to 8 Mcs, and contain 15 6 valves including 1-807, 2-6V6, 6-6K7, 2-6K8, 6B8, etc., als microammeter.

Units supplied complete with valves, leads, junction box, gen power supply and dynamic headphones and microphone operati 12v. supply.

£7/15/- F.O.R.

No. 11 TRANSCEIVERS

Supplied complete with valves, high and low power genemotors, leads, headphones and microphone.

£6/15/- F.O.R. PACKAGE 15/- EXTRA.

No. 108 TRANSCEIVERS

These 6-valve Walkie-Talkies are supplied complete with headphones and microphone.

£7/15/-

AMERICAN HANDY TALKIE, SUPPLIED WITH VALVES BUT LESS COILS AND CRYSTA TYPE BC/611, £4/15/-, POST AND PACKING 15/- EXTRA.

NEW 5BP1 C.R.O. TUBES £2/17/6

IN ORIGINAL CARTONS—

FOR THAT TV SET OR OSCILLOSCOPE

CERAMIC SOCKETS FOR ABOVE 4/6 EXTRA

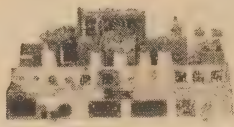
(Post and Packing Freight Rate—N.S.W. 12/6, Interstate 17/6.)

22 TRANSCEIVERS—CRYSTAL CONTROL

NEW CONDITION—FREQUENCY 2 TO 8 MCS

The Ideal Set for Small Ships, Fishing Boats, Fire Brigades, etc Sets, which are air tested and approved by the P.M.G., are su complete with 10 valves, 12v. vibrator power supply, 9in x 6in speaker, microphone and crystal to required frequency.

£29/15/- F.O.R.



RADAR RECEIVERS

These radar receivers type ZC955 contain 16 valves and a 30 Mc. I.F. strip suitable for your TV experiment. Units are in new condition

£2/17/6

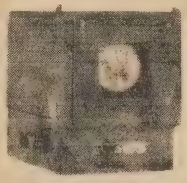
Packing 15/- extra

SCR522 GENEMOTORS

28 volt input regulated and filtered output filtered 300 volts at .26 amps. 150 volts at .01 amp; 14.5 volts at 5.0 amps.

Completely shielded in metal case, 12 x 8 x 5 inches.

Price, F.O.R. Each **25/**



INDICATOR UNITS

These indicator units contain 3 valves, controls, etc., and V.R.C. ACR/10 C.R.D. tube and socket. Ideal for the small scope.

(Used, fair condition.)

£2/15/- F.O.R.

24 Volt Midget Motors Shunt Wound

Fully Laminated Fields Wound Armature. Six-teen Segment Commutator, ball bearing. Ideal for Model Trains, Hobbyists, etc. Condition new.

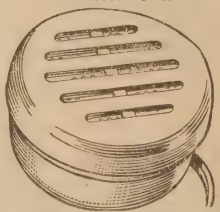
Price, each

25/-

Packing and postage: N.S.W., 1/6; Interstate, 2/6.

PILLO-FONE

EXTENSION UNIT

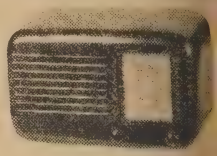


IT'S A REAL MINIATURE WITH ROLA UNIT. Install it anywhere, in the sickroom, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep.

22/6

POST FREE .. ..

MAKE UP THE "LITTLE GENERAL



£12/17/6

Complete kit of parts for the 1957 "General" as featured R and H inclu attractive bakelite cabinet with slide Price includes valves and Rola 5F speaker kit is complete to the last nut and bolt wired and tested £2/15/ extra) Cabinet size 11½in long, 7in high, 9in Foundation Kit for above comprising Bak Cabinet, Chassis and Dial Assembly

Post and Packing: N.S.W. 14/6; Interstate, 25/-.

New Command-Mid Genemotors

Input 24v., output 250v. at 60MA. Id electric razors, etc.

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.. ..	10/	1P5G	5/	6Y6GT	12/6	VR65A	2/6
.. ..	10/	1C7G	5/	6J7G	5/	CV6	3/6
.. ..	12/6	1K5G	2/6	6U7G	5/	36	7/6
.. ..	12/6	6AC7	2/6	6J6	15/	7193	3/6
GT	9/6	6C8G	7/6	6F8G	10/6	954	2/6
GT	9/6	6SS7	8/6	6A3	15/	955	10/
G	10/6	6F6G	9/6	7C7	3/6	12A6	10/
G	9/6	6H6	2/6	7A6	3/6	EF50	2/6
7GT	9/6	6H6GT	1/6	78	7/6	110TH	£2/9/
GT	10/	6J7G	7/6	71A	7/6	811	£1
8	10/	6K7G	3/6			866/866A	15/
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CALCULATING FEEDBACK RESISTOR VALUES

A frequent query from amplifier enthusiasts concerns the method of determining the value of the voice coil feedback resistor for voice coil impedances other than that originally specified.

FOR example, a feedback resistor of 3,500 ohms may be specified for a 15 ohm voice coil while you may desire to use a 2 ohm voice coil with suitable matching transformer. The problem is to determine the value of the new feedback resistor.

Most amplifier enthusiasts are aware that the impedance ratio of a transformer is equal to the square of the turns ratio and therefore for a given power output, the voltage appearing across the 15 ohm voice coil will be the square root of 15 over 2 or 2.24 times approx. the voltage appearing across the 2 ohm voice coil.

The problem now is to determine the value of feedback resistor to develop the same feedback voltage at some point back in the amplifier.

In most cases with voice coil feedback systems it will be found that the feedback voltage is developed across a low value resistor. A popular value is 100 ohms.

CIRCUIT ESSENTIALS

The essentials of the circuit are now a generator (the voice coil winding of the output transformer) and a voltage divider consisting of the "feedback" resistor and the low value resistor. Considering the problem in a slightly different light, we are attempting to determine the value of feedback resistor to produce the same voltage across the low value resistor when the generator voltage is varied by a given ratio.

It should be fairly clear that the voltage developed across the low value resistor will be proportional to the current flowing through it. If the value is low enough compared with the value of the feedback resistor, the current will be almost proportional to the value of the feedback resistor.

This is, in fact, almost always the case so that, for the example, the new value of feedback resistor is 3,500 divided by 2.24 or 1,560 ohms approximately. The nearest standard value, 1,500 ohms, would give slightly more feedback but would probably be the best choice.

STABILITY

Feedback amplifiers do not always have a sufficient margin of stability due to phase rotation in the system and an increase in the amount of feedback may be sufficient to cause instability. There are accurate methods of determining the stability margin but in most practical cases it would be sufficient to place a valve voltmeter across the output of the amplifier and increase the feedback slightly (place a resistor about 5 times the value of the feedback resistor in parallel with the feedback resistor) making sure that the amplifier does not oscillate.

Summarising the position, it is satisfactory to vary the feedback resistor as the square root of the ratio of the voice coil impedances, provided the feedback resistor is large compared with the resistor across which feedback is developed.

We cannot think of one of our amplifier designs where the above calculation would be seriously in error. The feedback resistor is only likely to be of the same order as the resistor across which feedback is developed when a large amount of feedback is to be applied to a small number of stages and the voice coil impedance is low.

Exactly the same principles apply but it is now necessary to do a proportion sum taking into account the value of the resistance across which feedback is developed.

There is a trap for young players here. If, for example, a 100 ohm resistor is placed in series with the cathode circuit of a valve, the presence of the valve does affect the impedance into which the feedback circuit works. The additional AC shunting due to the valve is approximately equal to 1/gm where gm is the mutual conductance of the valve Note that this varies with the plate current of the valve and may not always be equal to the figure published with the general characteristics. Curves of gm against plate current are available for many popular valve types.

Feedback amplifiers frequently include a capacitor in parallel with the feedback resistor. If you wish to use a voice coil impedance other than that originally specified it will be necessary to change the value of the capacitor as well as the resistor.

In general, the value of the capacitor will increase in the same ratio as the value of the resistor decreases and vice versa. Again by way of an example if you halve the value of the resistor it will be necessary to double the capacitor value.

Unfortunately in practice it isn't always as simple as this because the characteristics of a transformer with a voice coil winding for a different impedance may vary. Factors such as leakage inductance and the distribution of stray capacitance may vary even with the same transformer when secondary windings are connected for different impedances

The practical result of this is that the calculated value for the capacitor may only be approximately correct and may require adjustment when the amplifier is tested.

THE SERVICEMAN WHO TELLS

(Continued from Page 61)

a couple of hours I returned the set to the customer, making a note to check with him in a couple of weeks time — just in case. When I subsequently did this he assured me that the set had been perfectly quiet.

As to the exact cause, well, I'm afraid that will remain a mystery. There was obviously a fault of some kind in the valve; a dry joint in a base pin, a faulty weld on one of the support rods, or something of a like nature — but which only became apparent when the valve reached a certain temperature.

Presumably, when out of the cabinet, it was unable to reach this temperature, but the extra restriction on air circulation in the cabinet — or under my "magic" cloth — was the proverbial "last straw."

SETTING THE AGE ANCIENT THINGS

(Continued from page 19

rings showed an age of 880 years. carbon dating showed (from three 930 average. An acacia wood from the tomb of Zoser at Sakk known age 4,650 years gave an 3,979 years average from three ings.

The linen wrappings from the Book of Isiah found in a cave in tine and believed to be first or century B.C. was radiocarbon da average 1917 years.

OTHER USES

Many other examples are gi various tables by many workers r Professor Libby* of Chicago wh suggested the method in 1946, an Kulp of Columbia University

In addition to determining th of archeological specimens the r of radiocarbon dating has been a to problems associated with the g of the last Ice Age.

By determining the age of geo formations brought about by th ages of the vast sheets of ice covered great areas, events are ning to be placed on a more time basis and a geological time is thus being born which not onl give the exact date of ancient ever may assist the scientist in his effo elucidating the mystery of the ori matter.

Of course nothing is infallible a method is subject to error beca limitations of even extremely ac instruments but this is gradually overcome. At present allowances a ing made and ages of materials a ing given as the most likely age a deviation so many years abo below as for example 9,500 p minus 200 years.

MOBILE AERIAL

(Continued from Page 89)

Ignition interference has not p to be a problem in this particula but it often is extremely difficu eliminate. This could be the s of another article.

At a later date we may also b to publish an article describing the plete 30-watt installation.

A final point to note is that it is sary to obtain permission from local Radio Branch if you intend o ing 7 Mc mobile away from hon more than 24 hours.

REFERENCES

Belrose, "Short Antennas for M Operations." Q.S.T., September, 19

Roberge and McConnell, "Cap Hat Loading," Mobile Manual for Amateurs.

Also any recent edition of "The Amateur's Handbook."

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NSWERS TO CORRESPONDENTS

cton, N.S.W.) says he has managed to r enough transistors to build a portable it he is finding difficulty in getting ils and IF transformers.

difficulty is not surprising because these have not yet been released on the mar- normal radio parts suppliers. They are g hard to solve some of the attendant rior to general release. This is one of why we have held off but it won't be onger.

(Kurri Kurri, N.S.W.) has a valve type wishes to know if it differs from the A.M. would also like the pin connec- and the value of bias resistor required ration.

CV66 is completely different from the g a triode suitable for 250 m/c opera- regret that we are unable to give you nnections but an equivalent valve type ard RL37. It would be impossible for st a value of bias resistor without de- e circuit and conditions under which s intended to operate.

(Malvern, S.A.) sends us a circuit of a crystal set which he has copied from s magazine, and which uses a com- . Since the coil is not available he at we describe such a circuit in the

thanks for the suggestion D.B.R., and ep this in mind. Although the coil three windings it may be possible to ilar results with a single winding having of taps close to the earthy end, to aerial and crystal connections can be the meantime, try 10 or 12 turns on mer, using, say, 18 gauge wire, space the thickness of the wire, and with hand or one turn intervals. This proximate only, but should serve as a experiment.

(Seville, Vic.) sends us an extract from s magazine in which is described a receiver which operates entirely from ed from a nearby TV station, even programs it receives come from the adcast transmitters. He wants to know l describe a similar set for Australian

seem to remember reading the article n D.W.A., as well as some similar sug- other journals, mainly European, some

If we remember correctly we com- out it in the magazine at the time. s essentially a novelty, since there is ee that there would always be a ilable with sufficient field strength to necessary power. However, we may periments along these lines when time finally, we would intend it is tunate that it was not stated just how ircuit was able to "drive" a 12in

Collie, W.A.) writes to tell us of some eriments with crystal sets. He has he can receive a station three or four by connecting a germanium diode aerial and earth and then connecting ones across the diode. Further, he he can still receive the station with ire disconnected.

first condition in which the earth used is fairly easily explained since the detection action takes place in a y. However, since there is no tuning, uit would be unable to select the de- on from any others of comparable d would therefore not be suitable where ore than one strong station. Further, g between aerial and headphones which ieved by tapping into the coil is no able. This is another factor which will fficiency of your simple circuit. The out the earth wire probably works by e stray capacity between some part of and ground. We would expect the e less than with the ground connection.

Harat, Vic.) mentions that he has at- make a "Selectoject" device which has bed in the ARRL Handbook without e suggests that readers would be if we could describe a similar device local conditions.

we have not actually made the device n, we can see no reason why it would as claimed, if components specified ely available in this country, and the latively straightforward. Without any rmation, about all we can suggest is ll components and wiring very care- have no definite plans for describing evice in "Radio, Television and Hob- moment but it could well form part o system of a future amateur receiver.

East Preston, Vic.) sends us a photo- of data on the VCR97.

thanks for the data, which con- we had to say about the second the tube, except that it does provide s up to 2,500 to be applied to A1, able to make good use of the data a

M.G. (Coburg, Vic.) sends in an interesting list of questions for use in our "Answer Tom" page.

A. Thank you for your letter, which is a stout effort. We will try to answer your questions as space and time permit.

R.J. (Manilla, N.S.W.) writes to express his appreciation of the magazine and to report on the results of his first two attempts at set building. These were the De-Luxe Crystal Set and the Little Jim for 1955. He is particularly impressed with the crystal set which is the only set of this type which is capable of rejecting the local station sufficiently well to enable other stations, including Sydney stations, to be heard at night. He is also impressed with the performance of Little Jim and wants to know whether it could be used for short-wave listening. Other questions concern the use of long waves in England and the best way to take up radio as a career.

A. Many thanks for your report on the two sets, and the performance of the crystal set is particularly gratifying. The long wave band has been popular in Europe in the past, but is rapidly losing its place, along with the normal broadcast band, in favour of the VHF band. There does not seem to be much point in trying to use the Little Jim for long wave reception, since it is unlikely that any of these stations would be audible on it. However, such simple sets are normally capable of good results on the short-wave bands and we suggest something like the All Wave Battery Two of March, 1954 as the logical advance on your present set. A copy of the circuit and other data can be obtained through our mail service. If you intend to make radio your career we suggest that you may take either a Trades Course or Diploma Course at the University of Technology. The Trades Course requires the Intermediate Certificate (with possibly maths and physics as compulsory subjects) while the Diploma Course requires Matriculation. We suggest you contact the University authorities for more exact details.

T.W. (Canberra, A.C.T.) wants to know if we have published a book on the use of the oscilloscope and also whether there are any suitable panels available commercially for use on a home-made CRO.

A. We have not published a book T.W., but we did publish a series of articles entitled Putting Your CRO to Work, the first of which appeared in May, 1950. These issues are no longer available, but we suggest that you may be able to refer to them at your nearest large public library. A few name plates have been available from time to time, but we know of no ready supply at the present time. We suggest you raise the point with some of our advertisers who may be able to help you. Incidentally, you can probably obtain a book on the subject of using oscilloscopes from a technical bookseller. Several have been published.

D.McK. (Northbridge, N.S.W.) is a recent subscriber to our magazine and says he finds it very interesting. He suggests we may be able to publish a list of all the Australian amateur bands with any special details of individual bands.

A. Many thanks for your comments about the magazine and the suggestion you offer, but you could obtain this information on application to the Chief Radio Inspector, Wireless Branch, G.P.O., Sydney, along with other details of the amateur licence.

B.M. (Padstow, N.S.W.) wants to know if we can recommend a book on TV servicing of commercial receivers.

A. We doubt whether all the information you require will be found in any one book, since a good deal of basic knowledge will be required before service problems can be tackled. For Basic theory we suggest "Basic Television", by Grob, and for servicing, "Television Receiver Servicing," by Spreadbury. Note that the latter is written for English standards, but is still useful provided this difference is fully appreciated.

A.B. (Gerringong, N.S.W.) wants to know how to fit a record player to a commercial set, which he names.

A. This is not strictly within the scope of our query service, A.B., but is rather difficult anyway since we have no circuit details of the set you mention. Some versions used four valves, and some five, the latter being more suited to such conversion, though the others could be used. In either case it will be necessary to locate the grid of the appropriate audio valve (the voltage amplifier in the five valve version, and the power output valve in the four) and arrange to feed the pickup into this circuit. In the case of the power output valve the grid will have to be transferred to a new volume control across which the pickup will be connected. In the case of the five it may be possible to use the existing volume control, simply switching it from the detector circuit to the pickup. However, we feel that, as a beginner, it might be as well to enlist the help o someone on the spot who is a little mor experienced than yourself.

P.K. (via Kairuku, Papua) is interested in hig quality equipment to operate from battery supply He has in mind 6 and 12 volt accumulators a well as the 32 volt supplies frequently used in away-from-power locations.

A. Many thanks for your letter and we are very interested to note your opinions. We have given a good deal of consideration to country high fidelity systems but our efforts have been frustrated by the lack of suitable motors and turntables. There is a possibility that the position will improve before too long. The greater availability of power transistors in the relatively near future may also influence our decision to develop new audio equipment.

The Radio, Television and Hobbies Query Service

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Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

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NO WASTED TIME IN HEATING
The Scope Iron heats instantly, attaining full operating temperature in 6 seconds.

RN WHILE YOU D A RECEIVER

ntinued from page 55.)

Where there may be a chance eads touching other bare leads bolts etc. they should be n short lengths of insulated

n each case is the HT conn- these two are connected to- d then connected to tag 23. rn, must be connected to tag en tags 23 and 26 are mounted 22K resistors (m parallel) from tag 26 to pins 1 of the 6AE8. Lug 6, IFT2 is by- chassis by a .1 mfd paper A temporary connection should between pin 8, 6AE8 and tag

temporary connection is a capacitor from tag 26 to he purpose of these temporary s is to enable the set to oper- iently to be tested before to next month's section.

NG

ould complete this section and ink in terms of checking what one. Unfortunately this is not asy as in last month's section, urce of signal which will pass he IF channel will not be so ailable.

required is a signal at the te frequency (455 Kc), modu- some way, which we can the grid (pin 2) of the 6AE8. ything working as it should gnal will be passed through channel (being considerably in the process) applied to the nd finally appear as an audio the output valve and speaker. signal is normally obtained service oscillator" or "signal which is really a small . The frequency can be ad- r a wide range, covering the ls, the broadcast band, and l short-wave bands. It also an audio tone, generally 400 s, which is used to modulate . It is this modulating tone lly appears in the speaker.

ENT

ion to testing the circuit as uch an instrument is used for ," the adjustment of each IF r winding until it is tuned to 5 Kc. The adjustment is made of a threaded iron-dust core tre of the former, one being from each end of the unit. is unlikely that you will have instrument, you'll have to o borrow one or, better someone who will undertake hat you have done and align ansformers at the same time. , there is no need to be orried if this cannot be ght away. Admittedly you will the satisfaction of checking of the set, but the chances 's OK anyway. Even without ment, the IF transformers as hem will be fairly close to nd the set can be completed to work even if these are d.

Circumstances be tempted to fiddle with the IF adjustments at this stage. You will achieve nothing, and only upset what are probably fairly accurate adjustments. Later, we will tell you how to adjust these yourself if no other means are available.

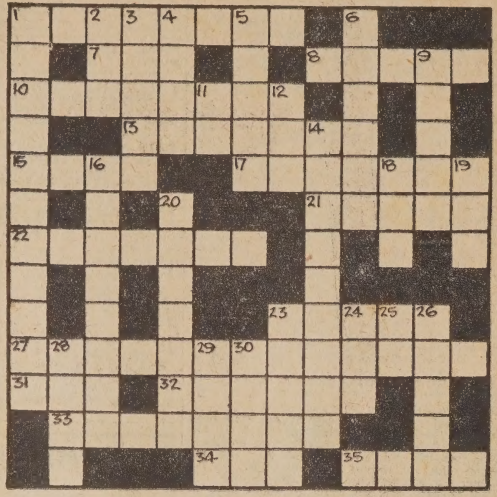
This should be enough for this month, but you should have ample time to finish it before the final section is described next month. This will consist of the aerial and oscillator tuned circuits, including the necessary coils and tuning capacitor, dial mechanism etc.

Meanwhile, you may still use the set as an audio amplifier in conjunction with a pickup if you prefer. Simply feed the pickup into the active end of the volume control as before, ignoring, temporarily, the IF transformer connected to it. If this facility is required permanently, it would be advisable to fit a simple change-over switch to divert the volume control as required.

(To be Continued)

Solution and further crossword next month

THE R., T.V. & H. CROSSWORD No. 51



ACROSS

1. Another name for back-coupling.
7. Mineral substance containing metal.
8. Instruct.
10. Loss in power mains supply.
13. Having no tendency to take a fixed position.
15. Examination (abbrev.).
17. Fire King of Incas of Peru.
21. Islands.
22. Valve element.
23. Price of passage (plural).
27. Laboratory instrument for measuring current.
31. Female sheep.
32. Almost.
33. Sudden occasion.
34. Element of the cyclotron.
35. Australian radio pioneer.

DOWN

1. Component of filtering circuit (2 words).
2. An infinitely long period.
3. Thoughts in a sleeping person's mind.
4. Garden plots.
5. Sound of a frog.
6. Exercises reciprocal effects.
9. Coil offering high impedance to AC.
11. Radio Telephony (abbrev.)
12. Please turn over (abbrev.).
14. In the first place.
16. Super-regenerative receiver.
18. The same.
19. Suffix meaning act, being.
20. Connections between sections of an aircraft frame.
23. A style of comedy show.
24. Second note of the diatonic scale.
25. Prefix meaning in, with.
26. Action of a beam of light in TV.
28. Stoneware jug.
29. Necessity.
30. Deadly poison.

Last Month's Solution

T	H	E	R	M	I	O	N	I	C					A
U		X		I		T		S	O	A	R	S		
N		P		C		T		L	S	D		K		
G	A	L	V	A	N	O	M	E	T	E	R			
S		O					A			L		S		
T	E	S	T	E	Q	U	I	P	M	E	N	T		
E		I				N		A				E		
N	E	O	N		R	O	S	T	E	R		P		
	A	N	T	S		S	U	E		E	M	U		
	S			C	H	A	N	N	E	L		P		
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ANSWERS TO CORRESPONDENTS

G.R.T. (Kew, Vic.) very kindly sends us some additional information concerning the VCR97s, based on the characteristics of two tubes he has recently purchased.

A. Many thanks to yourself and all the others readers who have offered information of this kind, G.R.T. In your case the information supports a similar suggestion already made, and is most valuable. We are filing all this information and hope to analyse it and publish it for the benefit of readers in the near future.

D.L. (Kew, Vic.) is puzzled by reduced volume in his set when fitted with an earth wire, while other sets he has observed give opposite effects.

A. Problems of this kind are often difficult to explain completely without a thorough examination of all the equipment involved. However, the following may throw some light on the problem. If a set is not fitted with an earth connection, the power mains act as an additional aerial and often contribute most of the signal. When an earth is fitted this no longer happens and signal strength is reduced. At the same time, any noise introduced by the mains will probably be eliminated, so that an earth connection is a good thing in principle. In cases where the power mains are not so effectively coupled to the set at signal frequencies the provision of an earth will often improve signal strength. We regret we could not offer an explanation for the aerial phenomena without a more detailed explanation of the effects observed.

F.F.E. (Karapiro, N.Z.) wants to know if we intend to describe a valve tester in the next six months.

A. A valve tester is something we have been promising ourselves for some time, F.F.E., but is one of those things we have had to put aside in favour of more urgent projects. At the present time it would be impossible to say whether we will get around to this in the time stated or not. In any case, it would have to be a simple emission type, at least initially, since this has many advantages in terms of simplicity, economy, and reliability, coupled with satisfactory testing, compared with the more elaborate types. We can assure you that any valve tester, to do what you have in mind, would be very, very "formidable" in terms of circuitry.

M.L. (Napier, N.Z.) writes to offer some constructive criticism of the magazine, ranging from satellite monitoring receivers to a plea for the reintroduction of the annual index. He also wants to know if we can supply coil data for the Short-Wave Seven Receiver of March, 1949.

A. Many thanks for your comments and criticisms, M.L., and we are always glad to hear our readers' views. Other readers have already raised some of these points and, if there appears to be enough demand, we may be able to do something along the lines suggested. Coil data for the receiver mentioned can be obtained through the postal query service in the usual way.

J.B. (Mossman, Nth. Q'ld.) has a number of queries concerning a high performance receiver he has constructed. He is interested in long distance reception on both the broadcast and shortwave bands.

A. If the receiver will receive signals at a level of about 2 microvolts with a signal to noise ratio of, say, 10 db we would say that you would be unlikely to do a great deal better. We would not recommend substituting 6BA6s for the 6U8 in both the R.F. and the first I.F. stage because the extra gain would most likely result in instability. A higher gm valve in the first R.F. stage may give a slight improvement in signal to noise ratio, especially on the shortwave band. The 6AK5 would be best from the point of view of signal to noise but is a sharp cut-off valve and may result in cross modulation in the case of strong signals on adjacent channels. On the whole we would be inclined to recommend the 6BA6. The signal to noise ratio is greatly affected by the design of the aerial coil. A high Q iron cored coil with close coupling between the aerial and tuned winding could well be an improvement on your present air cored coil. Provided it is fitted with a variable slug it should be possible to make the coil track with other coils in the set. Amplified A.V.C. has the advantage that it is possible to keep the output of a receiver flat over a wide range of input signal levels. A good delayed A.V.C. system without amplification will give an excellent characteristic which is adequate for most applications. Your 80 mA power transformer would probably be quite okay with 95 mA with choke input filter, particularly as the filament windings are lightly loaded.

T.C. (Brookvale, N.S.W.) wants to know if a 5in picture tube could be used in the 1958 TV Receiver.

A. We assume you are referring to the electrostatic deflection type commonly used in oscilloscopes, T.C., in which case there would need to be a lot of alteration to the circuitry. We may be able to publish something along these lines in the near future, and we suggest you wait until this is available.

WANTED TO BUY, SELL OR EXCHA

Advertisements for this column should reach us one month before the date of issue and cost 3/3 per line. There are approximately seven words per line.

BRITISH Sales Representative, 35, planning migration, 20 years' Radio field. 6 years' sales Radio, TV, Aerials, etc. Seeks like Australian position or sales office start with future results. Nomination requested, residing as convenient. **Longhurst, 93 Vimy Rd., Billesley, Birmingham, U.K.**

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J.B.A. (Alberton, S.A.) has an old four-valve set which varies in volume on one station only when various household appliances are switched off or on. He wants to know if we can suggest a cause and cure.

A. Your trouble would appear to be due to the signals from the offending station reaching the set at least as much through the power mains as through the aerial. When the length of wire in the power cables is varied, etc., the signal strength reaching the set also varies. We suggest that the set first be fitted with an efficient earth and aerial. The latter need not be elaborate, but should be outdoors and reasonably clear of the house wiring. If the trouble persists it may be necessary to fit a line filter between the mains and the set, but this would be unusual. We can supply a circuit if one is required.

R.H.D. (Redfern, N.S.W.) has constructed our two-stage regenerative transistor set with excellent results, but wants to know if we plan to add another stage to this design.

A. We have no such plan at the moment, R.H.D., since the transistor position is progressing at such a pace at the present time that we are concentrating on larger designs. We hope to publish something along these lines very soon.

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SELL: AWA 15w AC/Bat. Amp, £2 incom. £2; F Phone £3. 1 **Randwick.**

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